



OPPORTUNITIES

**TO ACCELERATE
GREENTECH MARKETS**

Clear opportunities exist for solution adopters, solution providers, financial investors, government regulators and other stakeholders to address challenges, accelerate the growth of greentech market and help China transform into an environmentally sustainable economy.

What can stakeholders do to overcome the challenges facing the commercialization of greentech solutions in China in order to accelerate the development of these markets?

THE CHINA GREENTECH INITIATIVE POSED THIS QUESTION to its partners and advisors, who helped develop the set of opportunities outlined in this chapter. These opportunities are not meant to be explicit recommendations, but rather suggestions of concrete steps different stakeholder groups may take to accelerate greentech markets and enable China’s further evolution to a sustainable economy.

While each of the greentech sectors analyzed in this report has its own characteristics and challenges, the Initiative identified five overall opportunities cutting across sectors which would have a significant positive impact on China’s greentech market development, as shown in Figure 1.

Fig. 1: OVERALL OPPORTUNITIES TO ACCELERATE CHINA’S GREENTECH MARKETS

OVERALL OPPORTUNITY	DESCRIPTION
RAISE DECISION-MAKER AWARENESS	<ul style="list-style-type: none"> ■ Help decision makers understand the benefits, costs and risks of green technologies
DRIVE THE MATURITY OF STANDARDS-BASED SOLUTIONS	<ul style="list-style-type: none"> ■ Support evolution of standards-based technologies to enable widespread adoption
SUPPORT FAIR MARKET PLAYING FIELDS	<ul style="list-style-type: none"> ■ Include costs into regulatory and market frameworks which properly value impacts of pollution and resource use
ENHANCE CAPABILITIES	<ul style="list-style-type: none"> ■ Build greentech skills necessary to design, develop, market, finance, implement, monitor and regulate greentech solutions
PROMOTE COLLABORATION	<ul style="list-style-type: none"> ■ Strengthen collaboration between public and private sectors and throughout value chains, at all stages of greentech solution life cycles

Fig. 2: KEY STAKEHOLDERS IN CHINA'S GREENTECH MARKETS

STAKEHOLDERS	DESCRIPTION
SOLUTION ADOPTERS	<ul style="list-style-type: none"> Organizations and individuals purchasing or using green technologies
SOLUTION PROVIDERS	<ul style="list-style-type: none"> Businesses who develop and provide green technologies and services
FINANCIAL INVESTORS	<ul style="list-style-type: none"> Commercial banks, private equity, venture capital, investment banks and other financial services providers
GOVERNMENT REGULATORS	<ul style="list-style-type: none"> China's central, provincial and local regulators, as well as relevant international policy makers
OTHER STAKEHOLDERS	<ul style="list-style-type: none"> Academia, non-governmental organizations, international organizations and other stakeholders

The Initiative also identified five over-arching opportunities relevant across all sectors and every stakeholder group. These opportunities, shown in Figure 2, present clear actions all stakeholders can take to expedite the development of a sustainable China. Sector-specific opportunities were also explored, and are discussed in the respective sector chapters of the full version of this report.

The five cross-sector opportunities are:

■ RAISE DECISION-MAKER AWARENESS

Educate decision makers about the benefits of green technologies, not only in terms of reducing negative environmental impact and risks, but also in terms of potential cost savings and other benefits from adopting greentech solutions. Raising awareness will help adopters overcome misconceptions and make informed decisions when evaluating greentech solutions.

■ DRIVE THE MATURITY OF STANDARDS-BASED SOLUTIONS

Drive and support the evolution of greentech solutions from the early research

Fig. 3: KEY STAKEHOLDER OPPORTUNITIES TO ACCELERATE CHINA'S GREENTECH DEVELOPMENT

STAKEHOLDERS	KEY OPPORTUNITIES
SOLUTION ADOPTERS	<ul style="list-style-type: none"> Promote sustainability Buy green Improve compliance
SOLUTION PROVIDERS	<ul style="list-style-type: none"> Match solutions to local market requirements Educate adopters to greentech benefits Supply products with minimized life cycle environmental impact Leverage commercial partnerships
FINANCIAL INVESTORS	<ul style="list-style-type: none"> Enhance capabilities Utilize new financing mechanisms
GOVERNMENT REGULATORS	<ul style="list-style-type: none"> Refine policies and optimize standards Enforce compliance Facilitate financing Liberalize markets Support environmental exchange
OTHER STAKEHOLDERS	<ul style="list-style-type: none"> Drive greentech training Engage other stakeholders Sponsor research Monitor compliance

phase to maturity. Standards-based solutions (i.e. those based on broadly-accepted industry standards) should achieve suitable pricing and provide adequate risk profiles to enable widespread adoption.

■ SUPPORT FAIR MARKET PLAYING FIELDS

Promote regulatory regimes and market mechanisms that incorporate environmental costs into the price of conventional solutions, such as mandatory caps, pollution fines, taxes and other mechanisms. For example, the U.S. Environmental Protection Agency's Acid Rain Program used cap-and-trade systems to increase the costs of polluting sulfur dioxide (SO₂), thereby driving the market for SO₂ removal solutions. The program led to overall significant decline in SO₂ emissions, which by 2008 were 56 percent below 1980 levels.¹

■ ENHANCE CAPABILITIES

Build leadership skills and staff capabilities across stakeholder groups to enable the design, development, marketing, financing, implementation, monitoring and regulation of China's greentech markets. This includes providing specialized training to managers, technicians, financiers, buyers, regulators and others across a broad range of greentech-related knowledge and skill areas.

■ PROMOTE COLLABORATION

Encourage collaboration between commercial, government and non-government stakeholders across all sectors and at all stages of greentech solutions' development cycles. As demonstrated by the China Greentech Initiative, collaborative platforms promote a range of benefits, including increased market understanding, relationship building, business model development, commercial venture expansion and improved dialogue between public and private entities.

The five overall opportunities identified above help frame the more specific opportunities available to each stakeholder group. Based on the input of partners and strategic advisors, the China Greentech Initiative focused its efforts on identifying and describing particular opportunities available to each major stakeholder group. These are summarized in Figure 3, and explored in the following pages.

Solution Adopters

ADOPTERS AND END USERS HAVE MUCH TO GAIN FROM THE DEVELOPMENT of China's green technology markets. In China and elsewhere, corporations are increasingly aware of the potential benefits that come from being environmentally-minded. Promoting sustainability may enable stronger relationships with customers, suppliers and employees. The use of green technologies, with direct and indirect cost benefits, can drive greater long-term profitability. Commitments to environmental sustainability also can help minimize negative impacts before being required by regulators.

PROMOTE SUSTAINABILITY

An organization that promotes sustainability internally with employees, and externally with local communities, is likely to gain the advantage of a good corporate reputation as its brand becomes associated with sustainability. With respect to environmental benefits, pioneering solution adopters can establish a significant multiplier effect as their interactions with suppliers, customers and business partners become more sustainability-oriented.

One way companies can minimize their environmental impact and create cultures of efficiency is by training staff in environmental awareness, which can lead to improved employee satisfaction, controlled costs and improved relationships with regulators and other stakeholders.

Chinese consumers are paying increasing attention to sustainability issues. Notably, the number of Corporate Social Responsibility reports issued by Chinese companies has seen a strong increase, from as few as four companies in 2004 to more than 121 by 2008.²

¹ United States Environmental Protection Agency, "Acid Rain Program 2008 Progress Reports: Emissions, Compliance and Market Data," <http://www.epa.gov/> (accessed on August 13, 2009)

² SynTao, *A Journey to Discover Values 2008: Study of Sustainability Reporting in China (Beijing, China: SynTao, December 2008)*, 8

PROMOTING SUSTAINABILITY IN THE ALUMINUM INDUSTRY

One company frequently cited for its endorsement of sustainability and support of greentech solutions is Alcoa, the global aluminum production and management company.

- Alcoa's sustainability strategy includes investing in green technology areas such as Carbon Capture and Sequestration and renewable energy-powered aluminum smelting facilities
- The company has adopted an internal strategic framework for sustainability through 2020, including targets for sustainable performance metrics in areas such as Safe and Sustainable Products and Processes and Respect and Protect Employees and Communities³
- As a result, Alcoa has received significant reputational benefits, including a listing in the Dow Jones Sustainability Index over the last seven years and being named one of the World's Top 100 Sustainable Corporations at the World Economic Forum in Davos, Switzerland⁴

Potential greentech adopters in China can strive to attain similar benefits by studying the approaches that Alcoa and other companies have taken to support sustainability, and adapting them to their own businesses.

The promotion of sustainability should go beyond an organization's internal practices and extend to the broader role of supporting long-term, ecologically-conscious economic growth in the local community. Helping to create an environmentally sustainable China is a key opportunity for greentech solution adopters and the local regulators who support them.

BUY GREEN

The most direct way solution adopters can promote China's greentech markets is by buying green, rather than conventional, products and services whenever feasible.

The first part of 'buying green' is identifying what is 'green.' Potential adopters can investigate the environmental impacts of their purchases and urge suppliers to participate in labeling programs or other transparent performance data. Sharing data, for example, helps tenants lease energy efficient office space, or further up the supply chain, assists building developers buy energy efficient lighting systems.

Another aspect of 'buying green' is fully evaluating the life cycle capital expenditure and operating expenditure implications of solutions. Many greentech solutions have higher upfront capital costs, but will still have net life cycle benefits due to decreased operating costs or long-term environmental benefits.

'Buying green' can also entail putting in place greentech systems to support effective environmental management. Regular energy audits, for example, help inform energy consumers about which parts of their operations may be able to achieve improved efficiencies. However, manual audits are often imprecise. The implementation of greentech systems to support accurate audits can help monitor the efficiency of devices used in homes (e.g. air conditioning units and refrigerators), large commercial buildings (e.g. water heaters and elevators) and industrial facilities (e.g. processing equipment and cooling systems).

IMPROVE COMPLIANCE

Solution adopters who comply with existing environmental policies can realize benefits while minimizing risk. While compliance with regulatory policies often necessitates increased costs, there are many potential benefits. For example, procuring and operating the solutions necessary to remove nitrous oxide from industrial smokestacks or to remove toxic contaminants from industrial wastewater can result in better relations with monitoring bodies, regulatory enforcers and other government entities.

Complying with policies reduces the risk of incurring financial penalties, or even being shut down, for non-compliance. As illustrated in the YiXing example, meeting regulatory requirements, especially when compliance is independently

³ Alcoa, "2020 Framework for Sustainability," <http://www.alcoa.com/>, (accessed on August 18, 2009)

⁴ Alcoa, "Alcoa Again Named One of the World's Most Sustainable Corporations at Davos," January 29, 2009, <http://www.alcoa.com/>

Benefits of Compliance^{5,6,7}

YiXing-Union Cogeneration Co., Ltd. is a coal-fired cogeneration power plant located in YiXing, Jiangsu province, a historic city famous for its teapots. Yixing teapots have a long and colorful history dating back to the Song Dynasty (960 - 1279) when purple clay was first mined around the YiXing area.

- Being located in the center of a historic city creates challenges for an industrial facility like the YiXing-Union Cogeneration plant
- To maintain good relationships within the local community, the company is an early adopter of advanced emission reduction technologies, including their spring 2009 project to lower nitrous oxide emissions
- Working with LP Amina, an environmental and energy solution provider, the facility upgraded their steam generator to become one of the first plants in China to perform an in-furnace de-NOx modification
- The modification improved the plant's overall efficiency and lowered its NO_x emissions to 40% below China's existing standard, in-line with current U.S. and European standards
- As a direct result of meeting mandates ahead of schedule, YiXing-Union Cogeneration is building a positive relationship with local and provincial governments
- In turn, regulators are now promoting YiXing-Union Cogeneration's results as a showcase of what they want other local power generators to accomplish

Being a good corporate citizen brings benefits both to YiXing-Union Cogeneration and to the broader YiXing community. As cities like YiXing continue to grow, companies like YiXing-Union Cogeneration can meet rising energy needs while protecting local environments and building strong reputations.

and transparently verified, can help companies build reputations as responsible corporate citizens and contribute to strong market positioning.

Policy compliance can also facilitate a company's ability to engage with regulators on multiple topics, including the evolution of policies and the optimization of standards. Firms with poor government relations may be less likely to be invited to such high-level forums of discussion.

Solution Providers

SIMILAR TO SOLUTION ADOPTERS, SOLUTION PROVIDERS have tremendous opportunities to accelerate greentech markets in China. These include better matching greentech solutions to local market requirements, educating adopters on greentech benefits, minimizing life cycle environmental impact of products and leveraging commercial partnerships.

MATCH SOLUTIONS TO LOCAL MARKET REQUIREMENTS

Many existing green technologies, developed for use in other countries, have yet to be customized to China's specific market needs. One potential difference between China and other markets, for example, is that Chinese adopters are often more cost-sensitive. More economically-priced solutions or new long-term contract structures can support the widespread adoption of already proven solutions.

Aside from pricing, unique market features, such as the type of pollutants in China's water bodies or the associated regulatory requirements, may also necessitate different greentech solutions than those required elsewhere. Once

⁵ China Greentech Initiative interview with Mr. Hu Zhijie, Deputy General Manager at YiXing-Union Cogeneration Co., Ltd. on August 14th, 2009

⁶ China Greentech Initiative interview with Will Latta, Managing Director at LP Amina on August 14th, 2009

⁷ Jiangsu Frontier Electric Technologies, "Boiler Performance Test Report after Combustion System Retrofit for Yixing Xielian Cogeneration Plant Boiler Unit #8, DL-BG-2009-767," 2009

PROMOTING GREENER CHINESE CITIES

GENERAL ELECTRIC (GE) PARTNERED WITH BEIJING'S QINGHE WASTEWATER TREATMENT PLANT TO RECYCLE WASTEWATER BEFORE THE BEIJING OLYMPICS.⁸

- Beijing is one of China's most water-scarce cities due to rapid urbanization and economic development, and exacerbated by limited water resources and strong upstream water consumption
- To address this problem, GE put in place wastewater treatment membranes and other technologies to treat effluent from Qinghe Wastewater Treatment Plant's clarification pool
- Aside from increased municipal water supply for the residents of Haidian and Zhouyang districts, Beijing residents and visitors during the Olympic festivities benefitted broadly from the numerous plants, trees and flowers which were irrigated by this recycled wastewater

solutions are adapted to these market needs and regulatory requirements, solution providers can market improved regulatory compliance as an additional driver for adoption.

By developing innovative market-specific solutions, foreign solution providers have the potential to improve their market share in China. Forging partnerships with local providers that help develop a better understanding of local needs may bring greentech solutions to market more efficiently.

Partnerships with local universities are also a productive way of working to adapt solutions to China's market needs. The Tsinghua-BP Clean Energy Research and Education Center in Beijing, with its numerous collaborative projects on a range of clean energy issues, is a prime example of this type of approach.

EDUCATE ADOPTERS ON GREENTECH BENEFITS

Given the current lack of recognition and understanding of greentech solution benefits, providers have an opportunity to educate potential adopters, helping to establish demand for greentech products and services.

Collaboration with other solution providers, adopters, NGOs or government agencies provides solution providers the opportunity to raise awareness and promote the diffusion of green technologies they represent. This type of engagement often allows enterprises to enhance their corporate reputations as environmentally-minded companies. As industrialized countries have developed, reputation building and brand enrichment have grown in importance, and there are few reasons to believe that China's experience will be substantially different.

Solution providers across China are also able to build consumer awareness about the advantages of adopting green technologies by working to improve environmental, health and safety conditions in the communities in which they are involved.

SUPPLY PRODUCTS WITH MINIMIZED LIFE CYCLE ENVIRONMENTAL IMPACT

Solution providers have significant opportunities to develop and commercialize solutions that minimize life cycle environmental impact.

Under pressure to minimize costs and to maximize profits, solution providers occasionally supply products with shorter life spans, resulting in higher maintenance costs and higher negative environmental impact than might be considered optimal from the environmental perspective. For example, residential buildings in China generally are of substantially lower quality than buildings in other countries and, correspondingly, have shorter life spans. Demolitions are both expensive and result in significant solid waste and air pollution. However, since landowners generally pay for the demolition costs to clear the area for construction, these costs are not factored into the economic models of real estate developers. Because of this, most developers and building owners fail to consider the environmental costs of demolition when deciding what real estate

⁸ General Electric, "Water reuse project of Qinghe Wastewater Treatment Plant," 2008

to develop or own. As China's greentech markets mature, providers with solutions that minimize life cycle environmental impact will be able to differentiate their products from the competition. These benefits can be further promoted by greater transparency and education about life cycle environmental costs and benefits.

LEVERAGE COMMERCIAL PARTNERSHIPS

Solution providers can address challenges associated with geographic diversity and cost-benefit disconnects by partnering with companies that offer complimentary geographical footprints or operate in different parts of the value chain. One good example of such partnerships is the new biofuel relationship between China National Cereals, Oil & Foodstuff Corporation (COFCO), Novozymes and Sinopec, which is profiled below.

Financial Investors

THERE ARE A NUMBER OF OPPORTUNITIES for financial investors to increase their ability to effectively finance and invest in China's greentech markets. Key opportunities exist in the development of greentech-relevant financing skill-sets and the employment of new financing mechanisms to support market development.

BIOFUEL VALUE CHAIN INTEGRATION OPPORTUNITY⁹

- As a leading grain, oils and foodstuffs import and export group in China, COFCO has access to biomass supply chains necessary for large-scale biofuel production
- The Danish company Novozymes has the technical expertise to optimize the enzymes necessary to convert the biomass resources from COFCO's supply chains into usable ethanol supplies
- On the distribution side, Sinopec owns roughly a third of China's gas stations, providing the infrastructure required to distribute ethanol produced by the partnership

BENEFITS:

None of these companies individually had the capacity to collect, process and distribute bioenergy supplies to commercial consumers in China. Without a formal partnership, each company would have had to enter into complex contractual relationships to guarantee that revenue generated from commercial customers could be passed through the supply chain for the benefit of all participants. A collaborative approach was required, so that the costs of bioethanol commercialization could be integrated with revenue, stimulating investment and creating a more profitable long-term partnership for all three companies.

ENHANCE CAPABILITIES

China-based financial investors have the potential to enhance their capabilities in areas such as the assessment and monitoring of clients' environmental, health and safety (EHS) risks. Another is mastering the use of new approaches to value investments in greentech sectors.

Improving EHS risk evaluation and assessment will likely allow for greater participation by financial investors in China's greentech markets. EHS risks include direct risks such as liabilities for environmental damages or more indirect market, credit or reputational risks as greentech businesses interact with the market. Similarly, revenue streams for solar or wind power generation are highly dependent on resource availability, and financiers have to take in to account significant potential disruptions to cash flow as a result. The greater the ability for China's financiers to assess the potential impact of direct and indirect EHS risks, the greater the ability they will have to invest profitably in China's greentech markets.

At a global level, 69 banks have adopted the Equator Principles, which include a voluntary set of benchmarks for managing environmental issues in development finance.¹⁰ These banks, however, are not actively financing China's greentech sectors. As of August 2009, only one medium-sized Chinese bank, Industrial Bank Co., had adopted the Equator Principles. Widespread adoption could help China's banks demonstrate a commitment to environmental principles and give them tools to enhance their project capabilities.

⁹ Novozymes, "Novozymes and Sinopec," <http://www.novozymes.com/>, February 2, 2009 (accessed on 12 August 2009)

¹⁰ The Equator Principles, "A Benchmark for the Financial Industry to Manage Social and Environmental Issues in Project Financing," <http://www.equator-principles.com/> (accessed on August 12, 2009)

OUTSOURCING ENVIRONMENTAL EXPERTISE

Investors can enhance their capabilities to evaluate greentech-related investments opportunities by collaborating with companies with established environmental expertise.

One option is outsourcing environmental help desks to third-party specialists. For example, PricewaterhouseCoopers has provided help desk services to assist financial investors with:

- **Integrating environmental criteria in credit processing, procedures and instructions**
- **Training credit officers, back-offices, sales offices and recovery managers**
- **Developing instructions, training documents and train-the-trainer concepts**
- **Ensuring compliance with environmental credit risk instructions**
- **Conducting environmental due diligences for various types of financial transactions**

The second opportunity is to increase the sophistication of the valuation approaches as used to assess the impacts of sustainability on clients' financial performance. In China, like elsewhere, financiers tend to use modeling frameworks and tools with which they are most comfortable. While traditional tools can support greentech financing decisions, they often need to be combined with other types of analysis that incorporate diverse perspectives (e.g. regulatory risk modeling of potential future pollution taxes) in order to fully capture greentech financing dynamics.¹¹

Chinese financiers could enhance their greentech capabilities as described above in a number of ways. The most common would be to partner with foreign banks and learn from their experiences. A second way would be to recruit specialized staff and develop training programs targeting the necessary skill sets. Alternatively, partnering with companies who can provide the necessary expertise on-demand can avoid the costs associated with building up new capabilities in house.

UTILIZE NEW FINANCING MECHANISMS

New financing mechanisms applicable to greentech investments could present additional opportunities for accelerating the development of China's greentech market. Relevant financial tools exist across greentech product cycles, from early-stage R&D through demonstration, deployment and diffusion of greentech solutions.

The earliest stages of greentech R&D in China and elsewhere are commonly funded by the public sector. However, there are opportunities for angel investors and technology incubators to get involved in early stages of financing technology development. Many venture capital funds also have capital that they distribute in relatively small amounts to early-stage companies. This type of financing should present an area of opportunity as it becomes more common in China.

Venture capital and private equity funds can play a more important role at the demonstration stage. China's central government is supportive of channeling venture investment into greentech projects and companies, providing financial investors with opportunities to build relationships with local regulators in order to facilitate their access to China's greentech markets.

Debt and equity financing for demonstrating and deploying solutions is also an important tool in advancing greentech opportunities. In asset-light greentech investment environments such as the pre-construction stages of solar power plant development, Chinese banks typically require full corporate guarantees on greentech investments and rarely offer non-recourse debt. Credit lines and loan guarantees between banks have been used in other regions to diversify credit risks and facilitate debt investment in this type of environment, suggesting there should be opportunities to further make use of this type of financing in China.

¹¹ CFO Research Services and Jones Lang LaSalle, *The Role of Finance in Environmental Sustainability Efforts* (Boston, MA, U.S.: CFO Publishing Corp., March 2008), 11

¹² International Finance Corporation, *IFC CHUEE Program to Finance Two Energy Efficiency Projects in Western China* (Washington DC, U.S.: The World Bank, 2007)

¹³ Xu, Calvin Q., "China Utility-based Energy Efficiency Finance (CHUEE) Program: One Finance Solution to Climate Change" (presentation given at Financing Cambodia's Sustainable Energies, Phnom Penh, Cambodia, September 3, 2007)

¹⁴ MacLean, John, "New Developments in Energy Efficiency Finance in China" (presentation given at Asia Development Bank's Asia Clean Energy Week, Manila, Philippines, June 4, 2008)

DEVELOPING MULTI-PARTY APPROACHES ^{12,13,14}

The International Finance Corporation (IFC) has a China Utility-based Energy Efficiency Finance Program (CHUEE), which addresses three key opportunities to enhance greentech financing in China:

- **Promote financing through guarantees** – The IFC provides partial guarantees to local banks for their investments in power utility energy efficiency projects or equipment purchases
- **Use partners to identify opportunities** - Utility companies, energy management companies and energy efficiency suppliers act as commercial banks' channel partners to recommend projects to bank loan officers
- **Build capabilities** – The CHUEE program contains a training element whereby banks can improve their skills in evaluating and monitoring environmental investments

While the CHUEE program has benefits, investors have also identified drawbacks to the program. Firstly, a relatively small number of banks are currently participating in the CHUEE program, and secondly, financing amounts may not be sufficient for the energy efficiency projects China's utilities would like to undertake.

Despite its drawbacks, the CHUEE program is a good starting point for effective greentech financing in China. The Chinese government and banking sector could build on the CHUEE experience to launch a program that can both scale guarantee financing instruments as well as mobilize financing partners' technical expertise to more effectively evaluate potential greentech investments.

Project finance, required at the demonstration and deployment stages of greentech commercial solution development, may require more complex and sophisticated financial instruments and structures. In addition to multiple debt and equity components, these can also include syndicated loans provided by a number of financial investors to share project risks. Standard Chartered Bank, for example, offers both project structuring advice as well as genuine non-recourse lending to well-structured renewable energy projects in China. This may be able to serve as a model for other banks in China seeking to do the same.

Several of China's greentech sectors are seeing the increasing use of equity investments as a way of raising capital. In China's water sector, for example, where financing a few years ago was obtained more commonly through Engineering, Procurement and Construction (EPC), build-operate-transfer (BOT) or other project financing approaches, water companies are now taking equity stakes in numerous water infrastructure projects.

Capital markets, both inside and outside China, also provide an opportunity for China's greentech companies to raise capital. Financiers can work with local greentech companies to support their flotation on the Shenzhen, Shanghai, Hong Kong or other markets. Packaging multiple risk-diversified greentech investments into a common portfolio and securitizing the portfolio to raise public capital is a method that can be used by financiers. Singapore's Hyflux Water Trust is an early innovator in this area with its Singapore-listed public security representing multiple water projects in both China and other countries.

Different greentech sectors have diverse needs and require customized financial products. As financial service providers innovate products to meet these needs in China there will be opportunities to uncover attractive greentech investments.

Energy service companies (ESCOs), for example, commonly carry out energy efficiency retrofits of buildings and industrial facilities and are reimbursed from the resulting electricity cost savings. For an individual building energy retrofit, generally

a relatively small amount of capital is needed upfront to finance equipment purchase and installation. In China however, where large-scale loans are the norm, many ESCOs find it difficult to secure financing.

Industry experts suggest that Chinese banks have an opportunity to launch new debt products specifically customized for ESCOs and individual energy efficiency retrofits. Similarly, third-party intermediaries could aggregate smaller energy efficiency projects across multiple entities and seek financing for these projects on a joined basis. In the U.S., where public buildings have been avid ESCO adopters and banks more willing to lend to small projects, the ESCO industry grew around 20% each year between 1990 and 2006, reaching over US\$3.5 billion annually by 2006.¹⁵

One other risk-related finance opportunity for China's greentech financial service providers is insurance. Environmental insurance products are used frequently both inside and outside China, most commonly to protect farmers from weather disturbances, but also to protect wind farms against wind resource disturbances. China-based insurers may also have the opportunity to insure assets and income streams of greentech financiers, solution providers and adopters.¹⁶

Government Regulators

AS STRESSED THROUGHOUT THIS REPORT, China's policy makers have already made substantial progress in creating and implementing policies that protect the environment and enable the development of the greentech market. Given the pace desired and magnitude of the challenges faced, policy makers still have a number of opportunities to support China's efforts to become an environmentally sustainable economy.

REFINE POLICIES AND OPTIMIZE STANDARDS

To address the challenges of China's complex greentech policy environment, China's policy makers can continue to support relevant medium and long-term policy planning efforts, placing emphasis on coordinating plans across multiple regulatory agencies. As outlined previously, China's greentech markets are overseen by a wide range of regulatory entities using a diverse set of policy instruments. This has resulted in a complex and at times confusing regulatory environment.

One approach used in other countries to manage the complexity of environmental issues is to introduce new cross-sector regulatory agencies. To manage the complex policy environment surrounding water issues, for example, Singapore's government created the Ministry of Environment and Water Resources, which has overall responsibility for water resources and coordinates the water policy activity of other regulators.

While the NDRC is putting in place some measures for national harmonization of energy policy, many of China's renewable energy market observers have pointed to feed-in electricity tariffs as an area where substantial policy divergence has occurred at local levels across China. Greater interprovincial coordination on this and other issues should improve the attractiveness of national markets.

Addressing policy gaps in specific greentech sectors also presents regulators with methods to strengthen target greentech markets in China. The country's government is moving rapidly to deploy a wide range of subsidies, tax benefits and other industry promotion policies to drive the development of China's greentech markets. Continuing to refine these policy tools to enhance their impact can only further benefit the development of China's greentech sectors. The China Greentech Report sector chapters identify policy circumstances in each of the seven greentech sectors investigated by the Initiative and highlight specific opportunities to accelerate market development.

¹⁵Hopper, Nicole et al., "A Survey of the US ESCO Industry: Market Growth and Development from 2000 to 2006," (Berkeley, CA, U.S.: Lawrence Berkeley National Laboratory, May 2007), 11

¹⁶United Nations Environment Programme and Global Environment Facility, "UNEP Feasibility Studies for the Development of Insurance Solutions for Renewable Energy Projects: Project Status Note Number Three," September 2008, <http://www.uneptie.org/>

Also at the individual sector level, opportunities exist to improve environmental and greentech solution standards above today's levels. China's government has made dramatic steps to upgrade many environmental standards, in areas including automobile emissions, building energy efficiency and potable water quality, to levels equal to or even superior to international levels. However, standardization represents a complex and fast-changing landscape, providing the government additional opportunities to further develop China's policy environment. Emerging greentech areas, such as coal mining land recovery and collapse provisions or interconnection of vehicles to China's electric power infrastructure, currently lack relevant standards, contributing to market uncertainty.

China has well-established standards development processes, but may accelerate greentech market development by enhancing collaboration with China's industry associations in order to incorporate greater diversity of technical expertise into the development process. In addition, as global trade increasingly links China's greentech markets with markets in other parts of the world, participating in the development of international standards and building domestic standards that are in line with international norms may enable China to more effectively import advanced technologies and export Chinese solutions to the world.

ENFORCE COMPLIANCE

China has taken dramatic steps in recent years to bring its policies and standards in line with international norms and best practices. Compliance, however, remains uneven across different regions and across different sized market players. While central policy makers usually draft the laws and standards with which market participants are required to comply, it is commonly provincial and municipal regulators who have enforcement responsibility. Central agencies may address this challenge by supporting centralized training programs for local regulators or highlighting strong cases of effective local enforcement as best practices to be replicated. The scale and speed at which China is trying to address its environmental issues in the absence of a single best-in-class model to follow make this effort more challenging, but also more rewarding as China has an opportunity to define a new model of sustainable development.

Regulators can also increase policy compliance by supporting the development of robust auditing or verification practices for policy compliance. As an example, companies under China's Top-1000 Energy-Consuming Enterprises program are required to submit annual energy audits to the government, but there are few standards for the methodologies or controls to be used in these auditing processes.

Outside China, governments sometimes outsource policy compliance monitoring to non-governmental entities. For example, Seattle, Washington, in the U.S., requires public buildings larger than 5,000 square feet to achieve LEED (a third-party green building standard) certification.¹⁷ Using a third-party certification and compliance monitoring mechanism precludes municipal regulators from having to maintain a policy compliance monitoring workforce.

Third-party verification of policy compliance can also have other benefits, particularly when local-level authorities have both regulatory and managerial responsibility for local state-owned companies. Independent policy compliance verification can help support transparency and political legitimacy, and can enable consumers to easily buy compliant products. In other countries, firms are often required to publicly disclose evidence of their compliance with environmental policies. This disclosure, in turn, allows consumers to show their preferences for green technologies through their purchasing activities.

An additional aspect of promoting compliance across China's industrial landscape relates to the government's potential role as an educator for potential greentech adopters around China. Government agencies have close relationships with many of China's industry associations, and this channel could be used as a

¹⁷ Stephenson, Janet, "Case Study: Seattle Sets the Standard for U.S. Green Buildings" (paper presented at the C40 Large Cities Climate Summit, New York, May 25, 2007)

FACILITATING GREENTECH DEVELOPMENT AND DEPLOYMENT

The economic development agency of the Republic of Chile has instituted programs to help power generating companies assess financial viability of renewable energy projects and to assist commercial banks in lending to the renewable energy sector.¹⁹

FOR RENEWABLE ENERGY PROJECT OWNERS:

- Project preparation matching funds for natural resource assessment, feasibility and environmental studies, and CDM documentation
- Cost-sharing on other areas of advanced project preparation

FOR RENEWABLE ENERGY INVESTORS:

- Credit lines for lending to renewable energy projects offering 30-month grace periods and repayment terms of up to 12 years allowing them to invest as much as US\$13 million in individual projects

conduit for government outreach efforts to inform potential greentech adopters about economic and environmental costs and benefits of their procurement decisions.

FACILITATE FINANCING

As noted above, in the early stages of greentech solution development, companies in China and elsewhere often rely heavily on public funding, either in collaboration with academia or through direct government support. With more than 20 subordinate institutes in its “Science and Technology for Resources and the Environment” research area, the Chinese Academy of Sciences (CAS) is one of China’s most influential channels for state-sponsored research. China’s government is already making significant investments in greentech research, but might have yet more opportunity to further use grants, prizes and other public funding mechanisms to support greentech innovation.

Directly funding greentech development through research institutes or grant programs is not the only way that China’s government can financially support the development of greentech in China. Obtaining debt financing is often a difficult challenge for greentech providers and adopters who are hoping to deploy greentech solutions in China. In the same way that many of these projects are often eligible for concessionary financing from international organizations like the Asian Development Bank, China can and already does make use of its policy banks to provide reduced-interest or otherwise favorable lending.

There is potential for China’s government to utilize a loan softening program (which often includes either an interest subsidy or a partial guarantee) to enable commercial banks to make risk assessment-based investments in greentech sectors on concessionary terms. The Indian Ministry of New and Renewable Energy, for example, has successfully used such an approach to help Indian banks offer loans for the adoption of solar water heaters.¹⁸

As a further opportunity to use policy tools to facilitate the flow of private capital into greentech sectors, China’s government can also support greentech market development by taking steps to help China’s financiers improve their greentech-relevant capabilities. China’s government is already helping to stimulate the expansion of these skills. As noted in the Regulatory Response chapter, China’s government rolled out a so-called Green Credit program in July of 2007 whereby banks were required to put in place environmental impact assessment and risk management controls for investments to environmentally damaging industries.²⁰

As the government directly supports and leverages China’s financial sector to support the development of greentech solutions, another area where China’s government can play a key enabling role is in the formation of a commercial

¹⁸ MacClean, John et al., “Public Finance Mechanisms to Mobilise Investment in Climate Change Mitigation,” (United Nations Environment Programme, 2008), 35

¹⁹ *Ibid.*, 15

²⁰ Ministry of Environmental Protection, “Calendar in July 2007,” <http://english.mep.gov.cn/>, November 27, 2007 (accessed on August 12, 2009)

environment conducive to greentech industries and solutions. The U.S.-China Clean Energy Forum, a dialogue on clean energy issues facing the two countries, has called for the creation of “Strategic Energy Zones” to facilitate innovation in new technologies, partially through the use of new financing mechanisms.²¹ Creating special industrial zones to promote the development of selected industries is an area in which China has extensive experience and national and local policymakers should be able to leverage this to further enable the development of substantial greentech industries.

LIBERALIZE MARKETS

As discussed in the previous chapter, some of China’s greentech markets are highly-concentrated or controlled primarily by state-owned enterprises. While there are important benefits to having certain industries under closer government control at critical stages in their development, more open markets also have clear benefits, particularly related to enabling efficiency and innovation. Finding the right balance will provide China an opportunity to effectively utilize foreign and private sector expertise and technologies to address its environmental issues, while also supporting the development of healthy domestic greentech industries.

One path is to create mechanisms for private and foreign participation in state-dominated markets. For instance, in the coal sector, regulators could accelerate market development by lowering tariffs on the importation of mining solutions and by encouraging foreign investment in coal mining and infrastructure development. Capitalization requirements and opaque public works bidding processes constitute barriers to private involvement in some greentech markets such as wind power. One approach regulators might take to promote efficiency and innovation in China’s greentech sectors could be a relaxation of restrictions on private and foreign market participation where appropriate. A further step regulators could take would be a continued gradual relaxation of currency exchange restrictions, which could help provide Chinese greentech companies easier access to foreign capital as an additional source of funding.

Another path regulators could pursue to support the financing of greentech solutions would be to establish special technology-focused or even greentech-focused capital markets, akin to NASDAQ in the U.S., to enable simplified flotation for greentech companies. The benefits of such a move could be compounded if new clusters of financial institutions could be developed, potentially in the same areas as these markets, to provide specialized finance opportunities.

More generally, many of the financing opportunities highlighted above can be fully realized only with strong regulatory support. This support could include best-practice guidelines for greentech public-private partnerships or other effective investment arrangements, such as power purchase agreements. Additionally, regulatory support could entail incentives for domestic commercial banks to issue concessionary loans through guarantee programs.

SUPPORT ENVIRONMENTAL EXCHANGES

Another opportunity regulators have for further promoting China’s greentech markets relates to supporting increased use of national and international environmental exchanges. These exchanges allow companies to respond flexibly to environmental policies by giving them options to purchase ‘environmental assets’²² from other companies rather than invest in the greentech solutions needed to create them themselves. This would allow market forces to allocate capital to projects that most effectively reduce emissions or achieve other environmental benefits.

It seems likely that environmental exchanges will continue to be a part of environmental issue management for some time to come. No matter where these future markets develop, Chinese greentech companies are well placed to benefit. China’s greentech adopters will be able to monetize their environmental assets and thereby gain additional channels for financing their capital investments. China’s

²¹ U.S.-China Clean Energy Forum, “Initiatives,” <http://cleanenergyforum.net/> (accessed on August 11, 2009)

²² While carbon emissions reductions are the most well-known environmental assets, other examples include emissions reductions of other air, water, or solid waste pollutants, or improvements in energy, water, or raw material efficiency.

greentech solution providers will meanwhile have opportunities to sell solutions to companies participating in relevant environmental markets.

Therefore, the question for China's regulators is how to most effectively support the development of environmental exchanges to bring resulting benefits to China's greentech providers and adopters. One approach would be to enable further participation in the Kyoto Protocol's Clean Development Mechanism (CDM). As noted in the previous chapter, there are limitations in place on foreign investments in CDM projects in China. Creating mechanisms for increased foreign involvement could facilitate greater deployment of advanced foreign CDM-applicable greenhouse gas emissions reduction solutions, such as landfill gas-to-energy technologies. Encouraging international environmental exchanges could also extend to supporting the creation of other international environmental exchanges, as successors to the CDM or otherwise.

Irrespective of developments at the international level, China has already established domestic environmental exchanges in Beijing, Shanghai and Tianjin. These exchanges are discussing future potential trading of sulfur oxide (SO_x), nitrous oxide (NO_x) and chemical oxygen demand (COD) emissions reduction certificates in addition to wider trading of carbon or other environmental assets. China's government could drive the development of China's greentech markets by further supporting the development of such exchanges.

As noted in the Regulatory Response chapter, China's government has gained experience with allocation of environmental targets to individual companies through the Top-1000 Energy-Consuming Enterprises Program. This experience should be useful if the government makes a move towards requiring company-level reductions of other types of emissions related to its national environmental targets. Once individual companies have targets for environmental performance, using exchanges to minimize the costs of reaching these targets is a logical next step, and one to which regulatory support could lend further momentum.

Like many opportunities to promote the development of greentech in China, building strong environmental exchanges is not something any one group of market stakeholders can do alone. Whether in relation to international or domestic environmental asset trading, China's greentech adopters will have to work with financiers to develop effective strategies for monetizing environmental assets and using them to support capital investments. Greentech providers will also have to work more closely with adopters to help them understand how adoption of specific solutions can be partially financed by capital mobilized through environmental exchange transactions. Other market stakeholders also have important roles to play in creating the environments necessary for vibrant environmental exchanges and spreading information about them to encourage companies to participate.

Other Stakeholders

A NUMBER OF OTHER STAKEHOLDERS, including academic institutions, non-governmental organizations (NGOs) and international organizations, also have interest in and potential ability to influence the development of China's greentech markets.

DRIVE GREENTECH TRAINING

A core opportunity is to develop and support environmental education and greentech training initiatives in China. Academic, non-governmental and international organizations often have considerable technical expertise in environmental issues, which qualifies them to support regulatory capacity building at national and local levels. One example of this support is the Joint U.S.-China Cooperation on Clean Energy (JUCCCE) Mayoral Training Program, which together with China's Ministry of Housing and Urban-Rural Development, trained over 50 mayors from China's largest cities on sustainability issues in 2008.²³

Like regulators, solution providers and adopters also require training in the economic and environmental values of greentech solutions in China. This

²³ TreeHugger.com, "Greening China's Mayors: A Q&A with Dr. Steve Hammer of the Mayoral Training Program on Energy Smart Cities," <http://www.treehugger.com/> (accessed on August 11, 2009)

knowledge can directly contribute to more effective investment decisions by solution providers and increased adoption by solution adopters.

General public training initiatives and campaigns also support the development of the greentech market. Many NGOs, such as the Jane Goodall Institute, organize public awareness campaigns on environmental issues within China. These campaigns effectively raise the environmental awareness of the Chinese consumer, who is encouraged to support environmentally-friendly products and services, thus accelerating China's greentech market development.

ENGAGE OTHER STAKEHOLDERS

Another opportunity for academic, NGO and international organizations is to leverage their independent status to build links and communications channels between solution providers, solution adopters, financial investors and regulators. For example, by hosting forums, conferences and other industry meetings they provide a range of market participants with platforms to exchange information and build relationships, as well as address policy issues with regulators.

Activities can develop beyond bringing stakeholder groups together. There are already a wide range of greentech conferences in China, but academic, non-governmental or international organizations should have further opportunity to move beyond conferences to action-oriented meetings and ongoing dialogues rather than one-off events. These unaffiliated organizations can even take direct action to support China's greentech market development. For example, Econet China, coordinated by the German Industry and Commerce Greater China, hosts an extensive directory of Chinese and foreign greentech companies on their website as a tool for companies to locate and contact each other.²⁴

Other organizations such as China Sustainable Energy Program (CSEP), funded by The Energy Foundation, provide grants to government-affiliated research institutes that aid in shaping the Chinese government's energy policies to reduce carbon dioxide emissions. The research institutes along with international policy experts advise the government on new energy policies.²⁵

SPONSOR RESEARCH

Academic, non-governmental and international organizations can also support the development of China's greentech markets by conducting and disseminating research in greentech basic science and greentech solutions. For example, research institutes at China's top universities typically have strong relationships with regulators, and are consequently in a good position to advise the government on issues as diverse as resource pricing policies and technical solution standards.

Outside of academia, other groups such as China's Energy Management Company Association (EMCA), an industry association with more than 200 company members active in the ESCO field, also conduct and disseminate greentech research. EMCA grew from 59 organizations in 2003 to 212 ESCOs in 2007 and assisted the NDRC in the management of a World Bank/Global Environment Fund project to build ESCO capacity in China. Much of its focus is on disseminating information on new policies and regulations related to energy efficiency and helping build ESCO capabilities.²⁶

MONITOR COMPLIANCE

Third-party stakeholders can play a role in creating and supporting mechanisms for tracking compliance with existing policies. The use of independent regulatory compliance monitoring is somewhat limited in China compared to other countries. While many smaller, more local NGOs in China have transparency issues and unclear agendas, larger international NGOs have opportunities to investigate whether or not market participants are in compliance with policies and promote information transparency.

²⁴ Econet China, "Company Directory," <http://www.econet-china.com/> (accessed on August 11, 2009)

²⁵ The China Sustainable Energy Program, "Approach," <http://www.efchina.org/> (accessed on August 13, 2009)

²⁶ Zhu, Lin, "Enhanced Stakeholder's Involvement in Energy Efficiency Action at Municipal Level" (presentation given at the International Seminar on Energy Efficiency Action at Municipal Level, Ulanbataar, Mongolia, May 9-10, 2006)

Opportunities Are a Starting Point

THE OPPORTUNITIES DISCUSSED IN THIS CHAPTER represent steps that China's greentech market stakeholders – solution adopters, solution providers, financial investors, government regulators and others – can take to address existing challenges, accelerate the development of greentech markets and contribute to China's environmental sustainability.

Developed with the input of the Initiative's partners and strategic advisors, these opportunities are intended to provide guidance, rather than specific recommendations, which can be customized and used in the decision-making processes of individual organizations. As such, these opportunities represent a starting point for the innovative steps that organizations will take over the next several years in China. More detailed sector-specific opportunities are included in the individual sector chapters of the full report.

With thousands of organizations and millions of people involved in the ongoing development of China's greentech markets, the China Greentech Initiative is optimistic that development challenges will be largely overcome, greentech markets will generally flourish and the country will accelerate its transformation to an environmentally sustainable future.