



12th Five Year Plan – *Chinese Leadership Towards A Low Carbon Economy*

April 4, 2011

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Over the past year at DBCCA we have written about and commented upon emerging Chinese leadership in the climate and renewable energy world. This comes in the form of the policy momentum and ambition of China's efforts to create a low carbon economy and improve its energy security through ambitious goals in terms of energy intensity targets and renewable energy deployment, backed up by strong incentives encouraging the development of green industries and jobs.

With China's introduction of the 12th Five year Plan on March 5, 2011, we see the many new and expanded strong policy initiatives and green targets in the Plan as clear evidence that China's low-carbon policies remain global best-in-class. According to Hu Angang of the Chinese Academy of Sciences, 33.3% of the targets in the 12th Five Year plan address resource or environmental objectives compared to 27.2% in the prior 11th Five Year Plan. This is borne out in the summary Draft 12th Five Year Plan¹ which contains a new section on "...energy conservation and environmental protection in responding to climate change" and lays out significant progress in key areas, describing the high-level objectives of China's National Climate Change Program. It is also stated that pilot cap-and-trade systems for carbon and other criteria pollutants will be undertaken. This global leadership in particular contrasts to the stalled efforts at the US Federal level. Gone are the days when commentators expected US carbon policy to lead the way for China to join a decarbonizing world!. Rather, it is now China who is preparing for carbon markets by 2013 and, as the world's largest manufacturing economy, it is stepping up to join the carbon markets in Europe.

The Draft Plan establishes goals for 2015, in addition to many of the 2020 targets already announced. China has targeted that energy intensity by 2015 will improve by 18%² from 2010 and non fossil fuel energy will increase to 11.4% of total generation. A total of 235 GW of renewable and low carbon energy generation capacity are also announced, with new 2015 goals including wind capacity increasing by at least 70GW (from 42 GW currently) and solar capacity increasing to 5GW (from 625 MW currently). Importantly transmission lines for renewable are also targeted for expansion as part of State Grid of China's announced plans to invest RMB 500 billion (US\$76.7 billion) over the next five years. Further, forest cover is targeted to increase by 12.5m hectares and high-speed rail is targeted to expand by 47,000 km between now and 2015.

Following the announcement of the Plan, events in Japan brought issues of nuclear safety again into sharp focus. In our estimation, China remains committed to low-carbon nuclear energy development as a necessary element of a national decarbonizing strategy. Despite the Fukushima event, we do not expect China to cancel any nuclear plants, although timetables for development may be disrupted as the experts evaluate safety upgrades and the feasibility of rapid migration to newer and safer nuclear designs. Signs of such a migration are occurring with announcement on March 24, 2011 that Huaneng Nuclear Power Development Corporation ("Huaneng") will commence construction next

¹ The summary details of the 12th Five Year Plan are in no single publicly available document and have been sourced from official documents including the National Development and Reform Commission, Premier Wen Jiabao's remarks before the National People's Congress, press releases from Xinhua, the state news agency and various press releases from State Grid Corporation of China, China Electricity Council, among others. Collectively, we refer to these sources as "the summary Draft 12th Five Year Plan."

² On March 28, 2011, China's Ministry of Industry and Information Technology announced more aggressive targets of 18% reductions by 2015 for both energy intensity and carbon intensity. These reductions represent greater degrees of improvement compared to the 16% and 17% targets, respectively, delivered by Premier Wen Jiabao on March 5, 2011.



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month of a 200MW Generation IV gas-cooled reactor in Shandong province. We believe that China will continue to look for the safest nuclear options. The prospect of a gap in low-carbon energy plans arising from what could be multi-year delays for an estimated 24 GW of planned nuclear capacity should, we believe, give a strong boost to cleaner energy sources such as renewable solar and wind, along with more gas for base load reasons. Further, we believe continued turmoil in the oil-producing regions of the world serves as further impetus for China to speed development of renewable resources as a means to reduce the China's strategic energy supply risk while nuclear safety and new reactor designs are reviewed.

In our estimation, the 12th Five year Plan create a broad range of climate change-related investment opportunities for: (1) equipment and services companies in the wind, solar power and hydro sectors; (2) equipment and technology companies in the low-carbon transportation sector and; (3) project finance activity in the several areas of renewable power farm development. The Fukushima situation and Middle East unrest, we believe, further amplify these trends.

We believe the continued trend toward higher energy efficiency also creates investment opportunities in the hardware, software and services areas since energy services and energy management businesses have received clear support in the 12th Five Year Plan. Shifts away from carbon-intensive electricity to both low carbon nuclear and cleaner natural gas generation are, in our opinion, likely to be fertile areas for investment as well.

Introduction

China's National People's Congress has approved the 12th Five Year Plan ("the Plan or FYP") and according to Wu Xiaoqing, vice-minister of environment protection, China will allocate more than RMB 3 trillion (~US\$460 billion) to the various green-related programs. This allocation of capital is consistent with plans announced in June 2010 that China would direct RMB 5 trillion (~US\$765 billion) into the decarbonizing process. The spending in the 12th Five Year Plan for the period 2011 through 2015 represents 60% of the investment capital allocated for the decade. While the 12th Five Year Plan document has not been publicly disclosed, it appears to DBCCA that the Plan will continue to place significant emphasis on green development, and that China is accelerating its path toward decarbonizing and cleaning up its power and industrial infrastructure. These efforts will likely be achieved through continued renewable and clean energy development, infrastructure overhaul, new limits on pollutants and through the establishment or broader adoption of resource and environmental taxes, along with plans to introduce pilot cap-and-trade mechanisms for both carbon and various pollutants. Table 1 sets out what we view to be the headline items contained in the summary Draft Plan published on March 5th, 2011.

The clear message in the FYP is national recognition that energy, resource and environmental constraints are threatening both sustained economic growth and social harmony. In fact, Climate Change is addressed directly in the 2011 Draft plan with reference to the National Climate Change Plan.



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Table 1: Key Goals in 12th Five Year Plan

Selected New Green Development Items	Selected Policy Extensions
<ul style="list-style-type: none"> • Carbon Intensity: ~4% reduction in 2011 and 18% cumulative reduction by 2015 • NOx reduction of 1.5% YoY in 2011 • Plans for resource consumption fees and environmental taxes • Plans for market-centric power pricing mechanisms including demand-side management and carbon and emissions/pollutant trading mechanisms • Establish and deploy a public system for GHG statistics and accounting • Add RMB 500 billion (US\$76.7 billion) to build cross-region UHV and other transmission lines to support long-distance power transmission and grid connection for renewable power 	<ul style="list-style-type: none"> • Energy Intensity: ~4% reduction in 2011 and cumulative reduction of 18% by 2015 • SOx reduction of 1.5% YoY • Target ‘new energy’ (non-fossil fuel use) generation as a proportion of total generation at 11.4% in 2015 rising to 15% by 2020 • 8% growth in electricity consumption and generation capacity including a 45% increase in grid-connected wind power, a 13.1% increase in nuclear power and a 6.1% increase in hydropower in 2011 • Add 120 GW of hydro capacity by 2015 • Add at least 70 GW of new wind capacity by 2015 • Add 5 GW of solar power capacity by 2015 • Establish 6 large on-shore wind farms and 2 off-shore wind farms by 2015 • Add 40 GW of low carbon nuclear capacity by 2015 • Add 4,700 km of high-speed rail line by 2015 • Increase the area of forest cover by 12.5 million hectares and forest stock by 600 million cubic meters by 2015 • Improve coal use efficiencies and expand natural gas production

Source: National Development and Reform Commission summary Draft of the 12th Five Year Plan dated 5 March 2011 and DBCCA Analysis, 2011

In reviewing the objectives contained within the Plan, we notice several new and positive actions along with continuation of highly successful policies that China implemented in the preceding 11th Five Year Plan (2006-2010). In Table 1, above, we call investors’ attention to items we believe are of “headline” importance including: newly introduced CO₂ GDP intensity goals, new limits on NO_x emissions, new resource use and environmental taxes, plans for market mechanisms for electricity pricing, metering and carbon and emissions cap and trade pilot programs and creation of a public GHG statistics and accounting system. There are additional new actions and policy extensions and expansions contained within the Plan that are summarized in Table 7, below.

Carbon and Pollution Market Mechanisms - China Making Steady Progress

China is well known as a generator of CDM credits, particularly for the European ETS. However, the Draft 12th Five Year Plan indicates that development of domestic carbon and emissions markets is also now of great national importance.

Although much talked about in the media, we believe that the Draft 12th Five Year Plan’s inclusion of carbon and pollution exchange initiatives, as a way to further spur development of a low carbon economy, are noteworthy and worth further review. In a nutshell, the summary Draft 12th Five Year Plan has made pilot programs in coming years for carbon and pollution exchanges core elements in a strategy to foster low carbon behavior above and beyond the mandates, standards and incentives that been so successfully deployed to date.



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In China, the notion of establishing domestic emissions trading schemes took substantive root in June 2006 when the People's Bank of China and the sovereign wealth fund, among others, began laying out a preliminary outline of such schemes. This effort was another sign that China was exploring all angles to encourage low-carbon behavior, including those relying on market dynamics. Further progress was made when Tianjin's Binhai New Area development plan was created in April 2008.

In August 2008 the Tianjin Climate Exchange, the China Beijing Environment Exchange and the Shanghai Environment and Energy Exchange were created. In February 2010, the Wall Street Journal reported details of the Tianjin Climate Exchange's first transaction, involving the sale of carbon credits from three over-achieving Tianjin regional thermal heating providers to Citigroup and the Russian natural gas company OAO Gazprom. This modest "voluntary" transaction, valued at RMB 500,000 (US\$76,687), kicked off the credits market in China and set the stage for primary industry, energy companies and other users of energy to monetize their energy efficiency performance in excess of established targets. While seemingly small in the context of the financial markets, we think the Chinese philosopher Lao-tzu's observation that "A journey of a thousand miles begins with a single step" is apt. A trade for 8,000 tons of credits generated during the 2006 Olympics was also monetized by a Shanghai-based auto insurer on the China Beijing Environment Exchange that same month.

By July 2010, the NDRC had come to embrace the carbon-trading mechanisms as cost efficient ways to further promote the changes necessary for China to achieve its carbon intensity reduction goals by 2020. Tang Renhu of China Datang Corporation noted that policy makers had come to realize that mandates, standards and incentives could not alone ensure achievement of China's energy and carbon intensity targets. Debate then centered on how to explore pilot programs and whether focus should initially be segmented by geographic region or by particular industry in order for the formative process to be manageable.

Further related action unfolded in August 2010 when the NDRC identified eight cities (Baoding, Chongqing, Guiyang, Hangzhou, Nanchang, Shenzhen, Tianjin and Xiamen) and five provinces (Guangdong, Hubei, Liaoning, Shaanxi and Yunnan) to pilot low carbon programs. The programs, while not necessarily calling for the creation of carbon exchanges, do require the provinces and cities to develop low-carbon economy plans that will touch upon energy usage, green building, industrial efficiency upgrades and a range of other green policies. Essentially, these programs create eight centers that may be material sources of credits for carbon markets to monetize to the extent the various areas exceed their improvement goals. Alternatively, for those businesses unable to achieve targets, the plans may also serve to create demand for credits. We see these thirteen areas as crucial next steps to creating supply and demand for carbon credits within China.

In the preceding months to the Cancun climate change discussions at the end of 2010, the NDRC publicly floated the idea of environmental taxes. Deputy Minister Xie Zhenhua of the NDRC also suggested that a carbon tax was under consideration. While such a carbon tax, per se, is not yet seen in the summary Draft 12th Five Year Plan, we look to the Chinese' consideration of one as further evidence of global leadership in bringing market mechanisms to encourage decarbonizing the economy.

In November 2010, a second international partnership took place, complementing the Chicago Climate Exchange's partnership with the Tianjin Climate Exchange, as NYSE Blue (a JV between NYSE Euronext and APX) began working with China Beijing Environment Exchange to develop the voluntary Panda Standard for carbon emissions trading. China Daily noted at that time that twelve environmental exchanges had come into being in China. We believe those in Beijing, Shanghai and Tianjin to be the three most significant.

We see the market mechanism aspects of the 12th Five Year plan, along with efforts to create the necessary emissions inventory, measurement and tracking systems as encouraging signs that China will continue to break new ground through 2015. Table 2 sets out a timeline of the key developments towards a cap-and-trade system in China.



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Table 2: China's Cap-and-Trade Development Timeline

China's Cap-and-Trade Development Timeline	
April 2008	Binhai New Area Development Plan creates the seeds for a carbon market mechanism
June 2008	People's Bank of China and China Investment Corporation, among others, start drafting outlines of an emissions trading scheme for the country
August 2008	Environmental exchanges are set up in Beijing, Shanghai and Tianjin
February 2010	The first carbon trades are executed in Beijing and Tianjin
October 2010	The NDRC affirms the prospect of environmental taxes in the upcoming 12 th FYP and notes that carbon taxes are also being explored
November 2010	A Panda standard is formulated
January 2011	The city of Wuxi announces a plan to map out a low carbon strategy consistent with the concepts being formulated in the 12 th FYP discussions
March 2011	A summary Draft of the 12 th FYP includes for the first time cap-and-trade as a policy to be implemented on a pilot basis during the 2011-2015 period

Source: DBCCA Analysis, 2011

We believe these positive initial steps represent a new trend in China's efforts to decarbonize its economy. We believe using market-based mechanisms to supplement continued mandates, standards and incentives will serve the two-fold purpose of assisting China in a transition to a low carbon economy while also building a high-value market opportunity for domestic and international investors. These market opportunities could take the form of both market infrastructure investing and emissions credit trading with and within China. As market mechanisms grow in other countries, we believe the nascent markets here in China will prove to be essential elements of a global emissions market, the end result of which will be a more optimal allocation of carbon costs across the global supply chain. On a global scale, we see this as a necessary element for businesses to make informed economic and planning decisions.

A balanced review of China's 12th FYP is needed. Some will look at the Plan and be pleased with the steps to further address climate change and environmental issues, and others may complain of tempered enthusiasm. Based on the summary Draft 12th Five Year Plan released on the 5th March (which we believe will be very similar to the final published plan), combined with incremental policy announcements (for example, on 18 March 2011 China's Ministry of Finance and Ministry of Housing and Urban-Rural Development jointly announced that by 2020 15% of building energy needs would be provided by renewable energy. Further on 25 March 2011 State Grid Corporation announced a target of 500,000 electric vehicles by the end of 2015. To support transportation electrification trend, State Grid expects to build 220,000 charging points and 2,351 battery swap stations during the same period.), we continue to believe China is implementing best in class policies and demonstrating global leadership in decarbonizing its economy. Table 3, below, provides qualitative comparison of China's low-carbon policy leadership with those policies in other select countries.



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Table 3: Climate change policy regimes around the world – China Best in Class

Country	Emissions Control			Financial Support				Long-term Grid Improvement Plan	Budget Strength (Deficit as % of GDP in 2010)
	Binding Emissions Target	Renewable Electricity Standard	Long-term Energy Efficiency Plan	Feed-in Tariff	Long-term Govt-based "Green Bank"	Tax Benefits	Long-term Funding Programs		
Germany	✓	✓	✓	✓	✓	✓	✓	✓	3.6%
China	✓	✓	✓	✓	✓	✓	✓	✓	1.6%
United Kingdom	✓	✓	✓	Microgen FiTs	Proposed	✓	✓	Proposed	11.5%
United States		State-Level		State, Local		✓			10.0%
India		State-Level	✓	State, Region	X	✓		✓	5.5%

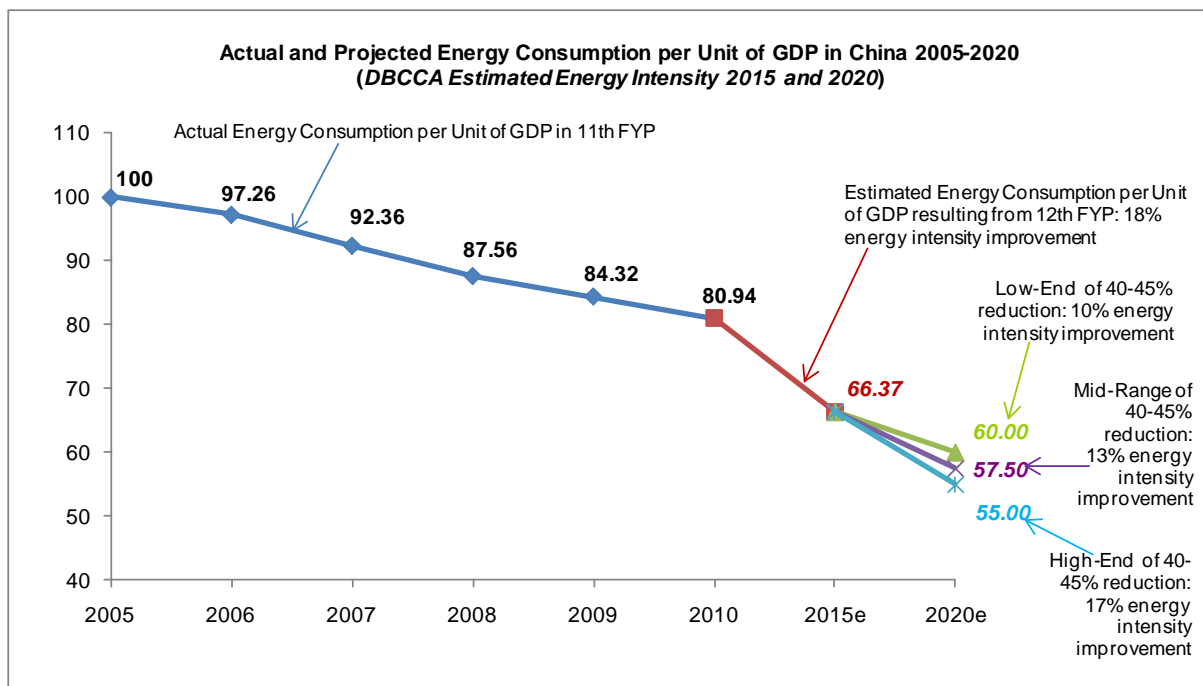
Source: DBCCA Analysis, 2010. = Policy exists at a sub-national level; = Policy is only in tentative or planning stages.

As shown in Figure 1 below, China should remain on track with the previously articulated goal of reducing 2020 carbon intensity by 40-45% compared to 2005 levels so long as any change to its nuclear roll-out is met predominantly by gas and renewable energy – the path we believe China will follow (see discussion later). By our calculation, we believe by 2015 China's energy intensity is targeted to decline to 66, or down 34% cumulatively from 2005 levels. To achieve the 40%-45% reduction goal by 2020, the future 13th Five Year Plan (2016-2020) would then have to have a 13% energy intensity reduction goal in order for the cumulative reduction to approximate 42.5%, the middle of the target range. Figure 1 illustrates the possible energy intensity trajectories under three different scenarios: (1) 40% cumulative reduction; (2) 42.5% cumulative reduction and (3) 45% cumulative reduction along with the implicit five-year reduction rates necessary during the 2016-2020 period.



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Figure 1: Actual and Projected Energy Consumption per Unit of GDP in China 2005-2020



Source: National Development and Reform Commission summary Draft of the 12th Five Year Plan dated 5 March 2011 and DBCCA Analysis, 2011, Ministry of Industry and Information Technology Press Release dated March 28 2011. NB: 2015 and 2020 Figures are DBCCA Estimates.

In terms of the power sector, key renewable industries will see expansion. Wind capacity is to increase by 70GW, with a 45% increase in grid connection, solar is to increase by 5GW and construction of 120GW of hydro will be started by 2015. Non-fossil fuel energy should reach 11.4% of generation under the Plan by 2015, on the way to 15% by 2020. Nuclear is discussed later in this note, but will still grow over time, potentially at a slower rate shorter-term which could increase the outlook for renewable energy. Given the announcements on March 28 of more aggressive energy and carbon intensity reductions of 18%, each, by 2015 compared to the prior targets of 16% and 17% reductions, respectively, we believe a portion of the more aggressive decarbonization will come from a mix of greater energy efficiency gains and non-fossil fuel energy mix incrementally higher than the 11.4% discussed in the summary Draft 12th Five Year Plan.

We believe the objectives set forth in the draft Plan reflect a sensible continuation and a broadening of China's efforts to decarbonize and "green" its economy. We suspect that as China simultaneously balances the complex objectives of (1) dramatic shifting of emphasis within the production and consumption sides of the national accounts; (2) significant efforts to clean up past environmental damage; and (3) addressing potential points of social disharmony, China's efforts will be both practical and achievable and will continue to demonstrate China's global best in class leadership role in actions to transform and green the economy.

Strategic Emerging Industries

The 12th Five Year Plan does not focus solely on climate change and environmental issues. Rather, the Plan is the proverbial master guideline for legislation and administrative policy intended to guide the continuing growth of China as an economy and as a country. It is a huge undertaking akin to a five-year social and economic itinerary for 1.3 billion travelers. As such, from both sectorial and operational perspectives, the Plan addresses a broad range of priorities including economic growth, social conditions, emerging technologies, innovation and



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governmental operation. The Plan designates certain industries, depicted in Table 4, as “Strategic Emerging Industries (SEI’s)”, sometimes referred to as “pillar industries”.

Table 4: Strategic Emerging Industries

12 th Five Year Plan – Strategic Emerging Industries
<ul style="list-style-type: none"> • Biotechnology • Clean Energy Vehicles • Energy Conservation and Environmental Protection • High-End Manufacturing Equipment • New Energy • New Materials • Next-Generation Information Technology

Source: National Development and Reform Commission, 2011; DBCCA Analysis.

The 12th Five Year Plan treats the green theme in a holistic manner and thus many aspects of the Plan, while not being explicitly green, have strong green dimensions to their implementation. We expect future policy to be planned, analyzed and implemented in ways such that green growth objectives throughout China’s economy are achieved. We note that SEI sectors in the outgoing 11th Five Year Plan exceeded targeted growth. Given the substantial technology support prescribed in the 12th FYP, we expect the growth for the new SEI’s to exhibit similar achievement. This is good news for those focused on the climate change impact, and related investment opportunities of the new 12th FYP, as many of the SEI’s are directly tied to (clean energy vehicles, clean energy) or highly related to (new materials, energy conservation and environmental protection) climate change themes.

Below are our views on the thematic winners and losers arising from the new SEI designations. Much of the focus, we believe, will be on energy efficiency and conservation measures as a rapid way to advance decarbonization while new energy systems will continue that process as they ramp to larger scale in coming years.

Investment Themes – Our View

Digging deeper into the SEI’s, Table 5 offers our assessment of where opportunities may be found within these themes and Table 6 adds further detail along with potential gating criteria or implementation risks.



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Table 5: Areas of Potential Investment and Rationalization Activity

Themes for Investment	Themes for Rationalization
<ul style="list-style-type: none"> • Industrial and residential energy conservation • Emissions control systems • Environmental clean-up • Energy performance contracting • Demand-side management • Smart Grid and Smart Transmission • Grid scale energy storage • Emissions measurement and audit • Green(er) transportation • Green building materials • Agricultural methane • Water conservation • High-efficiency manufacturing equipment • On and offshore wind-power • Solar thermal and solar PV • Natural gas power • Nuclear power • High-efficiency coal power 	<ul style="list-style-type: none"> • Older steel facilities • Inefficient or non-optimal petrochemical facilities • Inefficient non-ferrous mills • Excess ship-building capacity • Small-scale coal mining • Inefficient coal power plants • Inefficient salt operations

Source: DBCCA Analysis, 2011



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Table 6: Potential Investment Technologies and Services

Business Opportunities	Potential Risks and Restraints
Energy Services <ul style="list-style-type: none"> IT and network-leveraged service businesses aiding energy use awareness and management 	<ul style="list-style-type: none"> Changes necessary in commercial law and legal processes to support long-term contracts
Energy Conservation <ul style="list-style-type: none"> High efficiency lighting, motors, system automation, HVAC, energy audit services and carbon/emission cap-and-trade 	<ul style="list-style-type: none"> Achievement driven by available funding and supportive policies
Water Conservation <ul style="list-style-type: none"> Water irrigation and control, pumping and filtration, water recovery and desalination 	<ul style="list-style-type: none"> Careful coordination with provincial agricultural programs
Emissions Reductions <ul style="list-style-type: none"> Air and water emissions monitoring and control systems 	<ul style="list-style-type: none"> Funding and cost allocation
Market Mechanisms <ul style="list-style-type: none"> Demand-side management, market pricing for power, cap-and-trade for carbon and emissions 	<ul style="list-style-type: none"> Legal and financial sector reform and inflationary concerns
Green(er) Transportation <ul style="list-style-type: none"> Green engine systems, high-efficiency combustion technologies; energy storage and electric motor systems including controls, regenerative braking systems, emissions control systems; high-efficiency rail technologies including logistics services 	<ul style="list-style-type: none"> Technology and costs Recharging connections and grid integration
New Energy <ul style="list-style-type: none"> Wind, solar (thermal and PV), natural gas, nuclear, coal to liquids, biofuels and all related service and support businesses 	<ul style="list-style-type: none"> Technology, cost, grid interconnection and fuel provisioning Energy transformation driven increasingly by new capacity additions; low hanging fruit already harvested Offshore wind power likely to be protected for domestic vendors

Source: DBCCA Analysis, 2011

Additionally, and addressed rather broadly across all industry sectors with a focus on the SEI's, the draft Plan explicitly encourages technology innovation through a variety of policy measures. National R&D expenditures are targeted to rise to 1.9% of GDP in 2011 (2.2% annual average target for the entire 12th Five Year Plan) from the current 1.7% level.

Reading through the Summary Draft Plan we see several aspects that appeal to us from an investor perspective, as shown in Table 7.



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Table 7: Goals of 12th Five Year Plan – An Expanded View

New Green Development Items	Policy Extensions
<ul style="list-style-type: none"> • Carbon Intensity: ~4% reduction in 2011 and estimated 18% cumulative reduction by 2015 • NOx reduction of 1.5% YoY in 2011 • Plans for resource consumption fees and environmental taxes • Plans for market-centric power pricing mechanisms including demand-side management and carbon and emissions/pollutant trading mechanisms • Establish and deploy a public system for GHG statistics and accounting • Ammoniac Nitrogen reduction of 1.5% YoY in 2011 and cumulative 10% reduction by 2015 • Inclusion of flue gas de-nitrification for mandatory emissions control • Inclusion of heavy metal pollutants in targeted pollutant reduction schedules • Improve business conditions for energy efficiency service sector (e.g. comparable terms for financing energy, gas, and water that industrial players enjoy) and support for energy performance contracting • Inclusion of compliance measures in provincial and local cadre performance criteria for energy and environmental objectives • Steer foreign direct investment (FDI) toward energy conservation and environmental protection areas among others • Add RMB 500 billion (US\$76.7 billion) to build cross-region UHV and other transmission lines to support long-distance power transmission and grid connection for renewable power 	<ul style="list-style-type: none"> • Energy GDP Intensity: ~4% reduction in 2011 and estimated cumulative reduction of 18% by 2015 • SOx reduction of 1.5% YoY • Target 'new energy' (non-fossil fuel) generation as a proportion of total generation at 11.4% in 2015, rising to 15% by 2020 • 8% growth in electricity consumption and generation capacity including a 45% increase in grid-connected wind power, a 13.1% increase in nuclear power and a 6.1% increase in hydropower in 2011 • Industrial water consumption intensity reduction of 7% YoY in 2011 with a 30% cumulative reduction target by 2015 • Add 120 GW of hydro capacity by 2015 • Add at least 70 GW of new wind capacity by 2015 • Add 5 GW of solar power capacity by 2015 • Establish 6 large on-shore wind farms and 2 off-shore wind farms by 2015 • Add 40 GW of low carbon nuclear capacity • Industrial transformation in the steel, non-ferrous, petrochemical and ship-building sectors • Continued policy support for power grid automation (smart grid) and intelligence to accommodate greater intra-regional power transfers • Add 4,700 km of high-speed rail line • Add Aquatic O2 demand reduction of 1.5% YoY • Increase the area of forest cover by 12.5 million hectares and forest stock by 600 million cubic meters by 2015 • Improve coal use efficiencies and expand natural gas production

Source: National Development and Reform Commission summary Draft of the 12th Five Year Plan dated 5 March 2011 and DBCCA Analysis, 2011

In addition to the above topics, there are significant efforts within the Plan to advance biomass utilization and to expand the potential scale of biogas resources. From an agricultural perspective we expect the Plan to emphasize a shift toward larger factory-scale animal farming. One consequence of such a consolidation will be the availability of a proverbial high-quality, high-volume waste stream to serve as raw material for expanded biogas operations. As of the end of 2010, China is reported to have annual production of 1.55 TCF of biogas methane (as a comparison, this is ~1/16th of total US natural gas consumption of ~24 TCF), serving 40 million homes and an unquantified number of businesses.



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To meet the national energy intensity target, the NDRC has announced regional energy intensity targets³, with some regions expected to deliver greater savings while others will contribute less. We believe these regional differences reflect the relative proportion of industrial and manufacturing business activity relative to service business activity in each respective region. Table 8 provides the breakdown in energy intensity targets by region.

Table 8: Regional energy intensity targets under the 12th Five Year Plan

18% reduction	17% reduction	16% reduction	15% reduction	10% reduction
Group 1	Group 2	Group 3	Group 4	Group 5
<ul style="list-style-type: none"> • Guangdong • Jiangsu • Shanghai • Tianjin • Zhejiang 	<ul style="list-style-type: none"> • Beijing • Hebei • Liaoning • Shandong 	<ul style="list-style-type: none"> • Anhui • Chongqing • Fujian • Heilongjiang • Henan • Hubei • Hunan • Jiangxi • Jilin • Shaanxi • Shanxi • Sichuan 	<ul style="list-style-type: none"> • Gansu • Guangxi • Guizhou • Inner Mongolia • Ningxia • Yunnan 	<ul style="list-style-type: none"> • Hainan • Tibet • Qinghai • Xinjiang

Source: National Development and Reform Commission and DBCCA Analysis, 2011

Policy Harmonization – Coordinating Environmental goals in conjunction with political, economic and social goals

Although green development has a position of clear prominence in the 12th Five Year Plan, we believe investors should factor into their analyses the many issues the government must simultaneously address while fostering tactical advances and strategic growth for green development. Since the Plan maps out dramatic changes in the political, economic and social realms, execution of green objectives may occur in the midst of policy conflict.

For example, during the next five year period, China is targeting annual economic growth of 7% while at the same time attempting to:

- Cap inflation at 4% with a focus on food, energy and real estate prices;
- Address concerns over the social and healthcare safety nets;
- Address agricultural constraints and continuing to orchestrate controlled urbanization; and
- Address expansion of middle class GDP while rebalancing macro growth and income distribution within the country.

Some of the possible conflicts requiring deft and nuanced management will likely occur on the cost and labor fronts. A fully employed, wage-earning work force is a happy and 'harmonious' workforce that does not challenge the status quo. Yet the process of industrial transformation will inevitably create worker dislocation as older, inefficient facilities are retired. Thus, to mitigate possible unemployment problems and labor unrest, the government will have to carefully orchestrate, and perhaps pace, transformative closures in conjunction with job creation at newer, more efficient facilities in different and greener industries.

³ Consistent with footnote 2 located on page 1, the March 28, 2011 announcements of incrementally more aggressive energy and carbon intensity reduction targets of 18%, each, by 2015 are likely to result in modest revisions to the Table 8. We are not at this time able to estimate those reductions and expect them to take the form of higher regional reductions along with a possible recategorization of some regions into higher reduction categories.



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From a cost perspective, new technologies and the market mechanisms being discussed for energy and power pricing (e.g., tiered energy rates, DSM and cap-and-trade mechanisms for both carbon and selected pollutants) could potentially result in electricity expense becoming a larger portion of household expenses. Increasing power prices will require careful management in an environment where inflation is already running at a ~5% level, materially above the 4% target rate. Premier Wen Jiabao has stated publically that reigning in prices is China's top priority in 2011. Yet dramatic shifts in power system technologies and increased investment could, if not properly managed, influence end-market electricity prices. As noted in the summary Draft 12th Five Year Plan, *"...we must also be keenly aware that there are still some serious conflicts and problems facing domestic development."*

Additionally, resource use and environmental taxes could drive higher coal and natural gas costs, thus driving electricity prices higher. Looking at just the rare earths sector as an example, early discussions of such taxes suggest that these fees could result, we estimate, in an approximate ~\$560 per ton incremental cost.

Nuclear Issues – China Reviews Its Options

Recent events at Tokyo Electric Power's Fukushima nuclear power station in Japan are likely, in our estimation, to influence the trajectory of the decarbonizing process in China. We believe other clean energy sources (e.g. natural gas, wind power and solar power) could be the beneficiaries in the near term. We do not believe China will simply continue to build coal-fired generation capacity in lieu of delayed new nuclear plants. We believe China continues to view nuclear power as a cleaner baseload energy source relative to coal. Given China's growing energy needs to meet continued economic expansion and per capita GDP improvement, we believe China is likely to persevere with nuclear expansion subject to the completion of the safety reviews and implementation of any recommended safety upgrades.

With regard to Fukushima, we note this is the first time the world has watched a nuclear accident unfold in real-time. This fact alone will influence behaviors in ways that are unpredictable and different than in past nuclear accidents (namely Chernobyl and Three Mile Island). The initial responses over the weekend from the various players in the Chinese nuclear power sector suggested that China would resolutely continue with plans to rapidly expand its nuclear power base as an element of the country's low-carbon efforts. However Premier Wen Jiabao announced on March 16th that all construction and planning efforts for nuclear expansion would be placed on hold pending a safety and design review. Interestingly, on March 24th Huaneng announced plans to commence next month construction of a 200MW high-temperature gas-cooled reactor in Shandong province. This domestically developed, innovative reactor is reported to be a Generation IV design and is viewed by the Chinese as materially safer than the BWR design that experienced catastrophic failure in Japan as a result of the combined effects of a near-by 9.0 earthquake and ensuing tsunami.

We expect that China will continue to expand nuclear generation after a pause to review safety implications for plants currently in construction and in the planning phase. We believe such a pause will be briefer than might occur in the West. We take note of recent comments on 26 March 2011 made by Sun Qin and Pan Ziqiang, President and Director of the Science and Technology Commission, respectively, of the China National Nuclear Corporation, affirming that China would not waver from its stated nuclear development goals. The leadership is steeped in engineering and sciences and thus we believe they will conduct a rational and expedited nuclear safety review process. Note also that in the Chinese system, the citizenry does not have the same intervener option as those in the West may have, meaning any shift in public opinion against nuclear would likely have a minimal impact on government plans.



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Our best estimate is that China may spend 1-2 years reviewing and reconsidering plans for those plants still early in the planning process. In the quest for greater safety, we may see an accelerated shift to Generation III/III+ designs, thought to be an order of magnitude safer than Generation II designs. Huaneng's announcement appears to us to be a sign of such a trend given Premier Wen Jiabao's earlier direction that nuclear plans be placed on hold. Re-design efforts for Generation II plans could consume additional years. For plants currently in construction, we DO NOT expect China to cancel those plants. Instead, we believe China will work with the various engineering prime contractors to make modifications necessary to enhance safety and to continue construction. Of the nuclear plants in construction or in the early planning process, we estimate ~50% of the 56 GW that comprises this group to be of Generation II/II+ design.

Our preliminary estimate is that China may need to find alternative ways to redeploy perhaps 24 GW of future generating capacity. We think natural gas-fired turbines may be the most logical choice in light of base load requirements and exigencies to help China remain on a decarbonizing path and renewables power plans may also be reviewed with an eye toward accelerating these plans.

Should China opt to use natural gas turbines in the interim period while the nuclear situation is being reviewed, our preliminary estimates suggest incremental gas demand in China of 600 BCF/year, assuming 24 GW of natural gas-fired power generation was built and placed in service. To put these numbers in perspective, China's National Energy Agency notes that at the end of 2010, the country had a total power generating base of 970 GW. China National Petroleum Corporation estimates in 2011 China may consume a total of 4.6 TCF of natural gas. Based on this estimate, the incremental demand arising from placing 24 GW of natural gas-fired electricity in service would be around 13% of currently forecasted demand.

Concurrent with the safety review and evaluation of natural gas as a fuel alternative, we believe China will also likely accelerate plans for wind power and solar power deployment. Since the optimal venues for solar and wind power are not co-located with the major energy consuming industrial and population centers, we believe the various grid operators and power authorities will expedite transmission expansion and grid interconnection to facilitate bringing more wind and solar power into the energy mix. Further, acceleration in wind power development could result in China speeding development of high capacity wind turbines for offshore deployment in those coastal waters near major manufacturing sites.

With regard to nuclear, we do expect a pause as currently approved projects are re-vetted (and potentially re-engineered) for safety. While there are many moving pieces in this puzzle, we believe that China can review its nuclear program and still meet its CO₂ intensity goals so long as cleaner energy and renewable energy sources (including a mix of natural gas, wind power and solar power) are used to fill the gap. In fact, we expect the nuclear pause will likely serve as a catalyst to spur more rapid development of renewable energy sources, as well as encourage greater energy conservation and efficiency. This trend may also foster incremental renewable generation deployment as turmoil in oil-producing countries highlight China's strategic energy supply risks. With both the prospect of a possible pause in the pace of nuclear development in the face of unrelenting need to decarbonize the energy infrastructure and heightened foreign energy supply anxieties, we believe the 12th Five Year plan will serve as a powerful springboard for substantial renewables growth in China.

Concluding comments

In the coming weeks and months, following the approval of the 12th Five Year Plan, we expect planning documents for the individual sectors to emerge. After reviewing those detailed plans, we will have a clearer understanding of the unique nuances China includes in its plans for national green development. The latest



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intelligence from the Ministry of Technology suggests that plans for the new energy vehicles, high-end equipment manufacturing, new materials and IT SEI's will be published around mid-2011. It is unclear what timetable the National Development and Reform Commission ("NDRC") may have for release of planning documents for the biotechnology, energy conservation and environmental protection, and new energy sectors.

We think that the 12th Five Year Plan is without doubt a net positive for the greening of China, and continues to demonstrate China's global best in class policies to decarbonize the economy. The green imperative will be woven into the fabric of China's many other national objectives (such as fostering outsized growth for the SEI's), and the importance of green objectives will be simultaneously balanced with other pressing goals of economic growth, social well-being and harmony. In sum, the 12th Five Year Plan will have a practical flavor to it with realistic and measurable goals that should continue to drive sustained green growth in a country that has quickly become the largest low carbon economy in the world.



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I-021511-3.0

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