March 2011

THE CLIMATE GROUP

COMMISSIONED BY

HSBC
The world's local bank

This is part of
THE CLEAN REVOLUTION

DELIVERING LOW CARBON GROWTH

A Guide to China's 12th Five Year Plan

THIS REPORT HAS BEEN PREPARED BY

THE CLIMATE GROUP

AND COMMISSIONED BY
HSBC CLIMATE CHANGE CENTRE OF EXCELLENCE

HSBC
The world's local bank

ACKNOWLEDGEMENTS

REPORT WRITTEN BY
ALLISON HANNON. THE CLIMATE GROUP
YING LIU. THE CLIMATE GROUP
JIM WALKER. THE CLIMATE GROUP
CHANGHUA WU. THE CLIMATE GROUP

EDITED BY
BARRY KANTOR

DESIGNED BY
TRUE NORTH
GUYANG CHEN. THE CLIMATE GROUP

FRONT COVER IMAGE:
LED LIGHTS ALONG THE NAMING RIVER IN CENTRAL GUIYANG, GUIZHOU, CHINA.

ABOUT THIS REPORT

This report is a guide to the implications of China's 12th Five Year Plan (FYP) for the country's efforts to develop a lower carbon economy, considering related policies and trends in the process. It has been prepared by The Climate Group and commissioned by The HSBC Climate Change Centre of Excellence, building on the five-year HSBC Climate Partnership in which both organisations participate alongside WWF, Earthwatch and the Smithsonian Tropical Research Institute.

The findings are based on a review of successive drafts of the Plan, the most recent draft of which was presented on 5 March 2011 at the National People's Congress, supplemented by interviews and conversations (some on a non-attributable basis) with experts in the public and private sectors in China. It also builds upon earlier research into China's climate change and energy policy. Where the report considers CO_2 it focuses on energy-related emissions and excludes process emissions (e.g. from cement production), non-CO_2 greenhouse gases and land-use changes.

CONTACT DETAILS

The Climate Group in China
Jim Walker
jwalker@theclimategroup.org

The Climate Group outside China
Allison Hannon
ahannon@theclimategroup.org

HSBC
Nick Robins
nick.robins@hsbc.com

CONTENTS

FOREWORD

In the 12th Five Year Plan, China has signalled its intention to shift from a policy of maximizing growth to balancing growth with social harmony and environmental sustainability. China has impressed the world not just by the scale of its economic success, but also by the speed with which it has embraced a cleantech future. In the last five years, it has installed the world's largest wind power capacity, become the biggest manufacturer of solar panels and developed a dynamic market for electric vehicles.

Our research shows that the global economy will undergo a seismic shift in the coming decades as China becomes the world's largest market. The country's priorities for the next steps along this road are laid out in this latest Five Year Plan. As this report underscores, the Plan places low carbon growth at the heart of economic strategy in a way that no other country has done to date. China will simultaneously aim to drive down its carbon emissions per unit of output, while also stimulating the rapid expansion of the hi-tech sectors that will be pivotal in the future including clean energy, electric vehicles, and energy efficiency. For China, building a thriving economy based on low carbon growth, is not just an environmental imperative but a route to further prosperity and the means by which the country will meet rising aspirations for improved standards of living in terms of food, housing, transport and employment. In this transition, the role of banking and finance will be critical to provide households and companies with the capital to deploy cleaner, more efficient technologies.

As we confront the twin challenges of energy security and climate change, there are no ready-made models for economies to pursue. Governments, businesses and societies will all need to innovate to create the frameworks that reward low carbon investment. In the years ahead, many countries will be looking to China for inspiration on how this can be achieved. As a result, China's global role will no longer be just the world's fastest growing market for climate solutions, or the world's biggest exporter of key clean technologies, but also a source of ideas and experience on how to deliver low carbon growth.

Stuart Gulliver
Group Chief Executive
HSBC Holdings plc

EXECUTIVE SUMMARY

China has plans to continue its 'clean revolution' over the next five years, with significant targets for low carbon energy, energy efficiency and clean technology (Figure 1). The policy framework for this, as contained in the 12th Five Year Plan (FYP) covering 2011-2015, will be more sophisticated, with phasing in of market mechanisms and 'bottom-up' action in provinces and cities. The report concludes that China's low carbon ambitions are accelerating and will bend the nation's carbon emissions growth curve in the next five years. At the same time, the country's energy supply is incorporating more non-fossil fuel sources and low carbon technologies will continue to develop rapidly. The Chinese market for low carbon technology is gradually opening to foreign owned enterprises, but competition is intensifying. Finally, China's approach to energy management is evolving to include market mechanisms, but challenges remain.

	11TH FYP (2006-2010) (TARGET)	11TH FYP (ACTUAL)	**12TH FYP (2011-2015) (TARGET)**	13TH FYP (2016-2020) (TARGET)
INDICATORS				
ENERGY INTENSITY (% REDUCTION IN FIVE YEARS)	20%	19.1%	**16%**	NOT SET
CARBON INTENSITY (% REDUCTION IN FIVE YEARS)	NOT SET		**17%**	40-45% VS 2005
NEW ENERGY (% OF PRIMARY ENERGY)	10%	9.6%[1]	**11.4%**	15%
GROWTH RATES				
PRIMARY ENERGY CONSUMPTION (ANNUAL GROWTH)	4%	6.3%	**3.75-5%***	–
ELECTRICITY ENERGY CONSUMPTION (ANNUAL GROWTH)	–	11%	**8.5%***	(5.5%)*
ELECTRICITY GENERATING CAPACITY (ANNUAL GROWTH)	8.4%[2,3]	13.2%[4]	**8.5%***	(5.6%)*
GDP (ANNUAL GROWTH)	7.5%	10.6%	**7%**	–

ASTERISKED NUMBERS INDICATE ESTIMATES MADE BY GOVERNMENT THAT ARE NOT FORMAL TARGETS. BOLD NUMBERS ARE NEW TARGETS.

FIGURE 1

KEY ENERGY AND CLIMATE POLICY GOALS AND INDICATORS IN CHINA 2006–2020

CHINA'S LOW CARBON AMBITION IS ACCELERATING AND PLANS WILL BEND THE NATION'S CARBON EMISSIONS GROWTH CURVE

For the first time in a FYP, China has set a carbon-intensity reduction target of 17%[5] and intends by 2015 to reduce energy intensity a further 16%[6]. In real terms, therefore the 12th FYP should see China's CO_2 emissions risefrom an estimated 7.02Gt (gigaton) to 8.17Gt. This will avoid about 0.83Gt against the nation's previous trajectory (Figure 2)[7,8,9]. In real terms, therefore, China is bending its emissions curve downwards: the 1.15Gt planned rise in CO_2 emissions in the next five years compares with 2.2Gt added during each of the 10th and 11th FYPs. This ambition is driven by a need for China to: maintain growth and investment; address real resource limits; be economically and competitive and technologically advanced; and 'keep its house in order' to be a trusted voice on climate and energy. We believe that this will lay the foundation for emissions to peak before 2030[10].

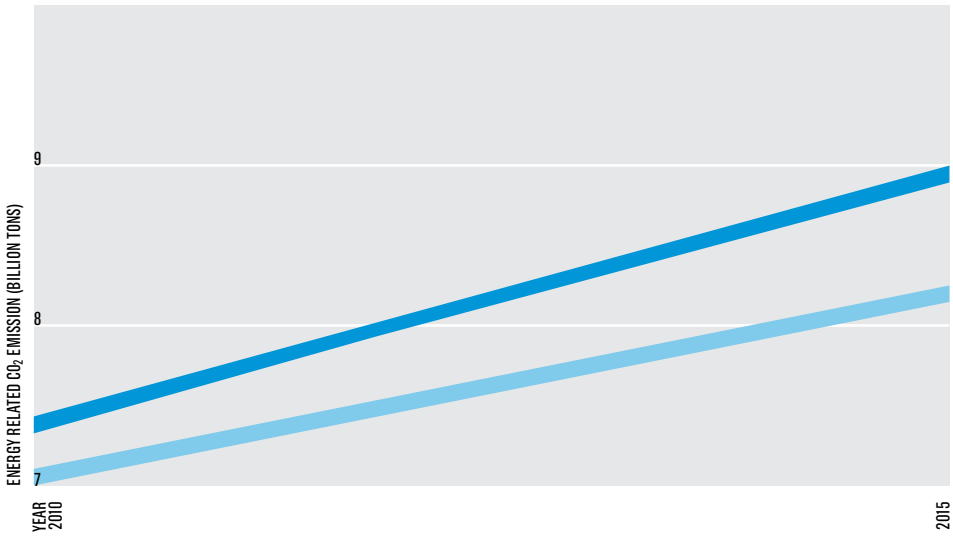


FIGURE 2

ESTIMATED EMISSIONS AVOIDED IF CARBON INTENSITY TARGET OF 17% FOR 12TH FYP IS REACHED, AGAINST IEA CURRENT POLICIES SCENARIO REFERENCE[1,11,12]

REFERENCE SCENARIO
17% REDUCTION

China's 'new energy'[II] targets also compare favorably with the International Energy Agency's (IEA) World Energy Outlook 2010 scenario for containing climate change by stabilizing atmospheric concentrations of CO_2 at 450ppm (parts per million) by 2010, suggesting that China is 'pulling its weight' with regard to building low carbon power generation (Figure 3). We believe that low carbon electricity deployment will be on or ahead of target.

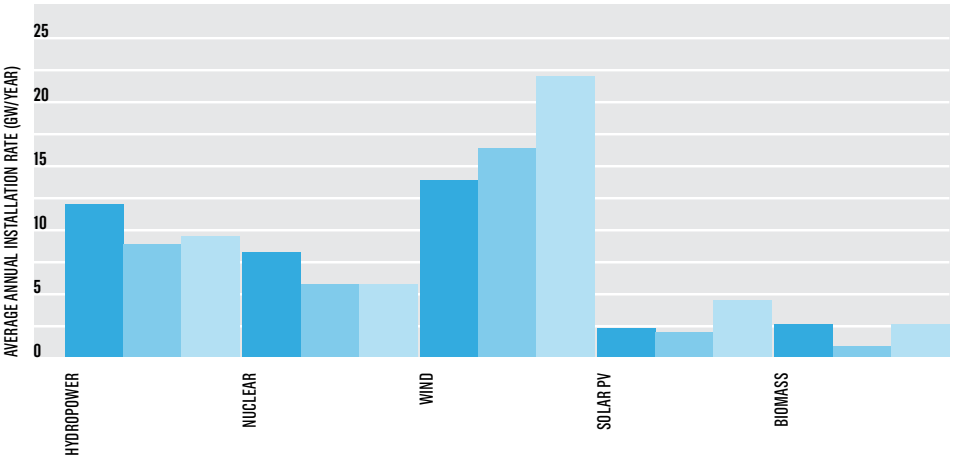


FIGURE 3

CHINA'S LOW CARBON TARGETS COMPARED TO IEA'S 450PPM SCENARIOS AND HSBC'S ESTIMATES[13] OF ACTUAL ANNUAL DEPLOYMENT ANNUALLY, 2010-2020

CHINA'S TARGETS
IEA'S WORLD ENERGY OUTLOOK 2010 450PPM SCENARIO
HSBC ESTIMATES

I While the 12th FYP 17% carbon-intensity target includes afforestation, we assume that 17% is a useful reference given that the associated 12th FYP energy-intensity target is 16% and the new-energy percentage is expected to increase over the five-year period.
II The term 'new energy' is used throughout the 12th Five Year plan and other relevant policy documents to cover alternatives to standard coal-fired generation – these sources include nuclear, large-scale hydroelectric and renewable energy.

GROWTH IN ENERGY SUPPLY WILL INCORPORATE AN INCREASING SHARE OF NON-FOSSIL FUEL SOURCES

China reached a 9.6% share of primary energy from non-fossil fuel sources in the 11th FYP, primarily by installing low carbon power generation capacity, against the target of 10%[14]. Challenges came from larger than predicted overall energy consumption and from delays in developing hydroelectric and nuclear power over the last five years[15,16]. Current indications are that these technologies will now progress more rapidly with stronger government backing. Progress on low carbon energy will come from a four-fold growth in nuclear power to 40GW (gigawatts) [17], 63GW of new hydroelectric capacity, a growth in gas-fired generation[18,III], 48GW[19] of new wind capacity to more than double the current capacity and solar capacity expected to reach 5GW by 2015[20]. These figures are against the backdrop of an estimated additional 260GW of coal generation[21] (Figure 4) – although the share of coal in the energy mix is anticipated to fall from 72% to 63% (Figure 5).

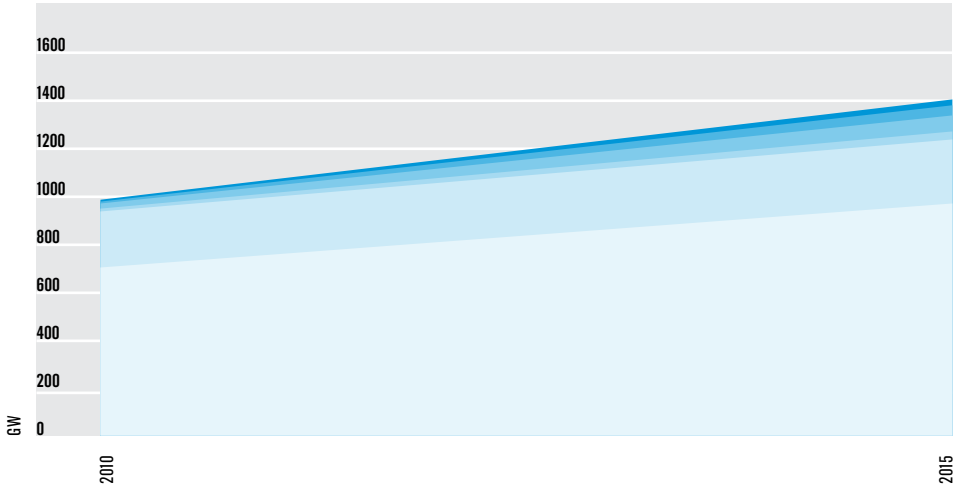


FIGURE 4

TARGETED GROWTH IN INSTALLED GENERATING CAPACITY (GW) FOR 2015, COMPARED TO THE CURRENT MIX[22,23,24,25,26]

SOLAR
GAS
WIND
NUCLEAR
HYDROPOWER
COAL

FIGURES TAKEN FROM PUBLICLY AVAILABLE DATA FROM THE NATIONAL ENERGY BOARD AND THE CHINA ELECTRICITY COUNCIL

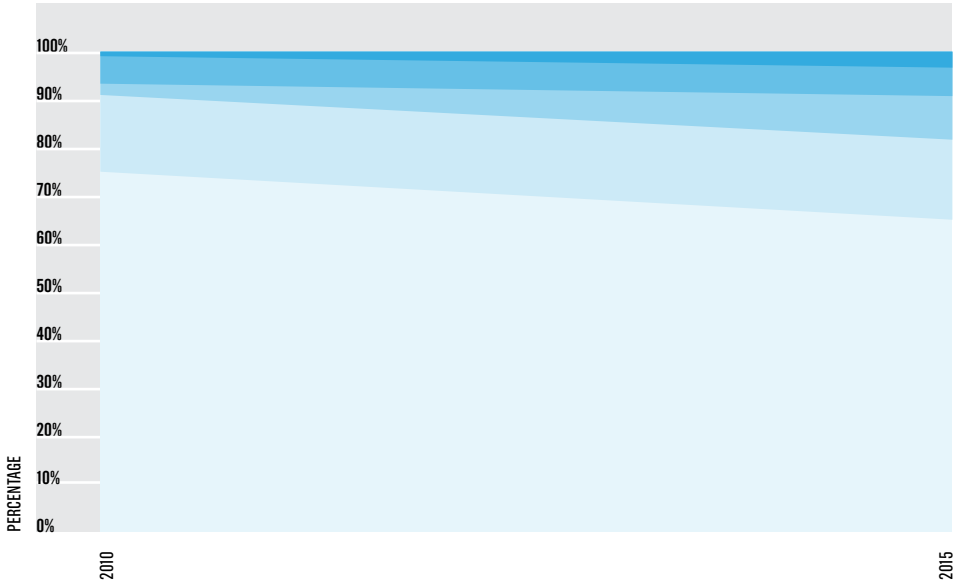


FIGURE 5

TARGETED CHANGE IN THE COMPOSITION OF CHINA'S PRIMARY ENERGY SUPPLY BY SOURCE, 2010-2015[27,IV]

RENEWABLE
HYDRO AND NUCLEAR
NATURAL GAS
OIL
COAL

FIGURES TAKEN FROM PUBLICLY AVAILABLE DATA FROM THE NATIONAL ENERGY BOARD AND THE CHINA ELECTRICITY COUNCIL

III Projections for gas fired power range from 13GW growth to 30GW growth by 2015.
IV Coal, whose share of energy increased to 72% in the 11th Five Year Plan, is anticipated by the government to reduce to a 63% share of the mix by 2015.

CHINA WILL ACCELERATE THE GROWTH OF LOW CARBON TECHNOLOGIES

Considering both export and domestic consumption, the 12th FYP sets out aggressive growth plans for strategic emerging industries (SEIs) critical to economic restructuring, including electric vehicles, next generation information technology, energy efficient products and renewable energy. A figure of RMB 10 trillion (US $1.5 trillion) of public and private investment in the next five years across all SEIs has been discussed but a government target may not be set. Fiscal incentives form part of an integrated strategy. Research and development funding is set to increase dramatically, leveraging public and private sources from the current 1.7%[28] to reach 2.2-2.5% of GDP[29]. Technologies including new-energy vehicles and LED lighting are set to play a big role in the longer term, as China's large-scale manufacturing will drive down international prices.

THE PICTURE WILL GRADUALLY OPEN UP FOR FOREIGN-OWNED ENTERPRISES (FOEs) BUT COMPETITION IS INTENSIFYING

Following the trend of state-owned enterprises (SOEs) opening up to foreign equity investment, participation in national R&D programs will gradually open up to FOEs. But access to direct funding is likely to remain restricted to majority Chinese joint venture partnerships. China recently announced moves to strengthen its intellectual property (IP) regime under the 12th FYP, which is increasingly significant for its own domestically-derived IP. The extent to which this will impact FOEs' experience of operating in China is not clear, however.

CHINA'S APPROACH TO MANAGING ENERGY IS EVOLVING WILL BE MORE MARKET-ORIENTED, BUT CHALLENGES REMAIN

The 12th FYP measures include regulation, technology development, capital investment and market mechanisms. We expect a better-planned phase-out of inefficient infrastructure and clearer devolution of central targets by sector and province. Data quality on energy continues to improve[V], enabling more effective regulation. Market mechanisms, including energy price reform, carbon trading pilots, energy labelling of consumer products and support for energy services companies, will be actively developed and are likely to form a key element for China's energy policy framework by 2015.

On the national agenda since 2002, energy price-reform has become urgent to rationalize investment, and market mechanisms are an experiment for a nation accustomed to administrative regulation. Industrial energy efficiency measures remain critical to success[VI]. Some local governments struggle with limited capacity to implement changes and still perceive energy intensity reduction to be at odds with economic growth. Access to capital for energy efficiency projects is a priority, especially for non-SOEs. Nuclear and hydroelectric power will take higher priority in this FYP. Coal-fired generation and heavy manufacturing still make up the lion's share of China's emissions (81%)[30]. There is no provision for carbon capture and storage in the FYP although it remains a development priority in energy R&D. Although absolute coal-generating capacity will increase, outstripping new energy growth in 2015, the share of coal in the energy mix will decline.

The targets are set and the plans are in motion to build on the ambition of the 11th FYP for China's movement towards clean and efficient energy use. The 12th FYP makes it clear that China is determined to capture the economic opportunities that exist from addressing climate change.

V Based on preliminary and final energy values from 1990 to the present day published by the National Bureau of Statistics, showing diminishing errors in energy data over time. Increased academic and research interest in China's energy statistics similarly has led to more accurate data over time.

VI A Special Energy Conservation Plan anticipated from the National Development and Reform Commission (NDRC) later this year will be significant in this respect.

OUTLINE

The outline of the 12th National Economic and Social Development Plan, (hereafter referred to as the '12th Five Year Plan', 'FYP' or 'the Plan') was officially presented in Beijing on 5 March, 2011 at the National People's Congress, China's national law-making body. The Plan sets out the government's framework for the overall direction of the Chinese economy and in this report we review those elements of the Plan which deal with delivering low carbon growth.

This report is structured as follows:

- Section 1 introduces the Plan, giving the context, drivers for action and emerging trends
- Section 2 focuses on elements of the Plan that are relevant to China's progress towards a low carbon economy, particularly its on-going efforts to drive down carbon-intensity through energy-efficiency measures and the deployment of 'new energy'[VII]
- Section 3 reviews the new plans laid out to develop a suite of strategic emerging industries (SEIs), many of which will be central to energy efficiency and low carbon energy in the future
- Section 4 considers China's prospects for success and we present the conclusions of our review
- Annex 1 represents China's policies for SEIs in diagrammatic form
- Annex 2 provides a summary of China's new climate and energy policy in the 12th FYP
- Annex 3 presents a diagram of China's main energy policy mechanisms

In this review we have focused on the new elements introduced by the Plan but have also taken into account relevant existing and on-going policy processes and trends.

VII The term 'new energy' is used throughout the 12th Five Year plan and other relevant policy documents to cover alternatives to standard coal-fired generation – these sources include nuclear, large-scale hydroelectric and renewable energy. In the New-Energy Industry Plan, 'new energy' also covers the development of 'clean coal' technologies applied in coal-to-gas, coal-to-liquids and integrated gasification combined cycle (IGCC). 'Clean coal' is not included in new-energy generation and purchasing targets.

SECTION 1: INTRODUCTION

CONTEXT

Learning from the 11th five year period (2006-2010)

In 2006, China's 11th FYP laid out aggressive energy targets that attracted international attention. It planned for a 20% reduction in energy intensity and for 'new energy' to reach 10% of primary energy by 2010. Against these targets China did manage to achieve a 19.1% reduction in energy intensity (Figure 6) and 9.6% of primary energy from non-fossil fuel sources while carbon intensity declined by 16.2% (2006-2009 only) (Figure 7). The extent of the different energy-intensity measures undertaken during the 11th FYP period are indicated in Figure 8. Over the term of the 11th FYP state investment in energy efficiency reached over 130 billion yuan (US$19.76 billion) (Figure 9) while energy consumption avoided through efficiency totalled 100 million tons of coal per annum. As part of this drive, 70GW of small, inefficient coal-fired power generation capacity was shut-down[33,34].

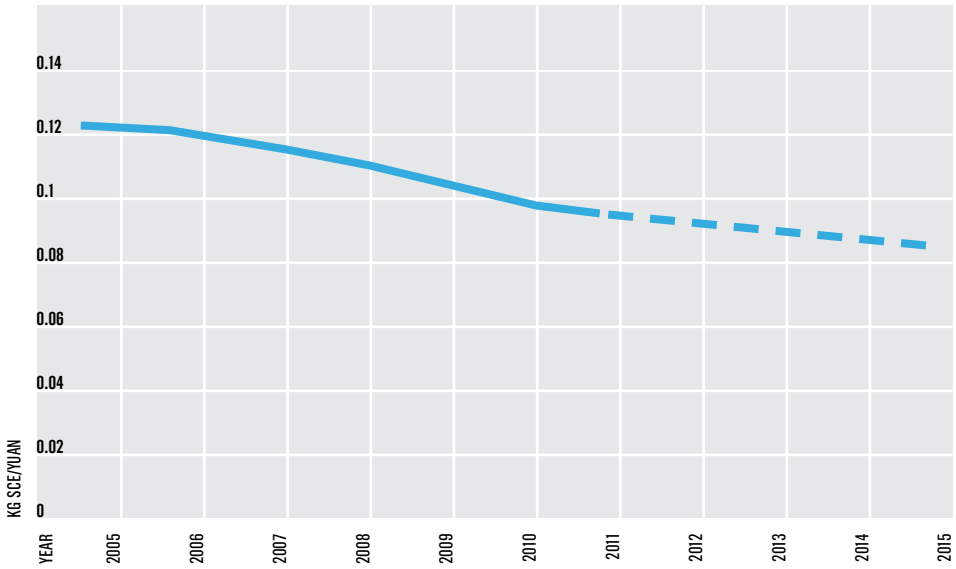


FIGURE 6
PROGRESS ON CHINA'S ENERGY INTENSITY (KGSCE/YUAN) (STANDARD COAL EQUIVALENT PER YUAN) IN THE 11TH FYP PERIOD[35] AND PROJECTED IMPROVEMENT BY 2015 BASED ON 12TH FYP TARGETS

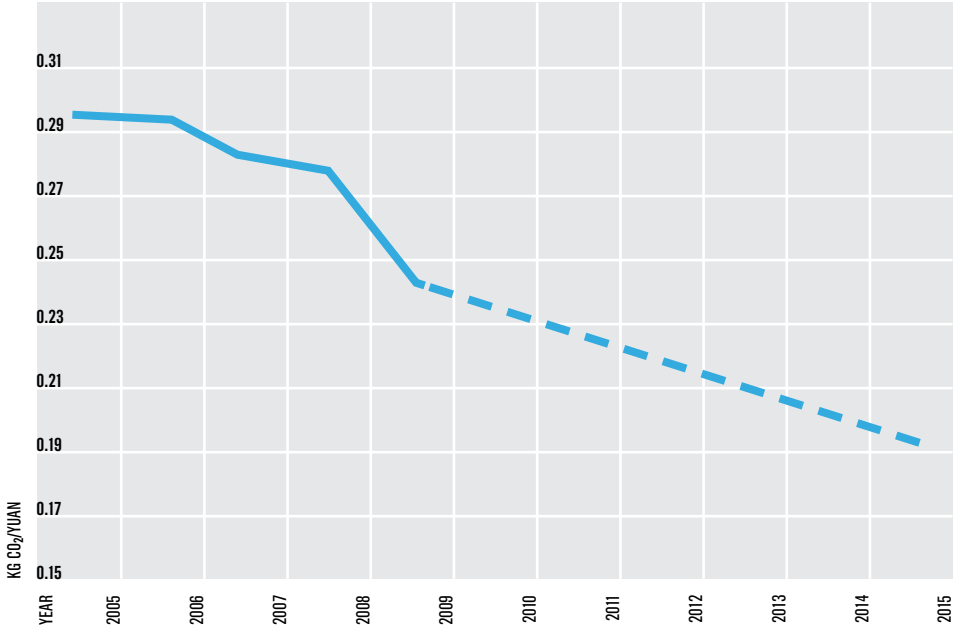


FIGURE 7
CARBON INTENSITY (KG CO_2) OF CHINA'S ECONOMY, COMPARISON OF DATA 2005-2010 WITH THE 17% CARBON-INTENSITY REDUCTION TARGET FOR 2015[36]

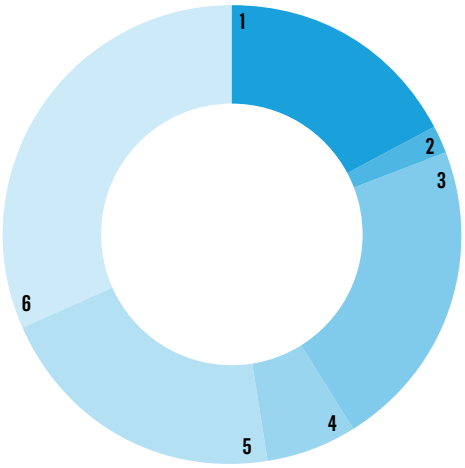


FIGURE 8

SOURCES OF CHINA'S PRIMARY ENERGY SAVINGS (MILLION TONS CARBON EQUIVALENT), 2006-2008, BY POLICY MEASURE [38, VIII]

1 THE 'TEN KEY PROJECTS' ENERGY EFFICIENCY PROGRAM	102
2 PROTENTIAL OVERLAP	12
3 SHUTTING DOWN INEFFICIENT PLANTS	129
4 APPLIANCE STANDARDS	37
5 TOP 1000 ENERGY CONSUMING ENTERPRISE PROGRAM	124
6 PROVINCIAL PROGRAMS	185

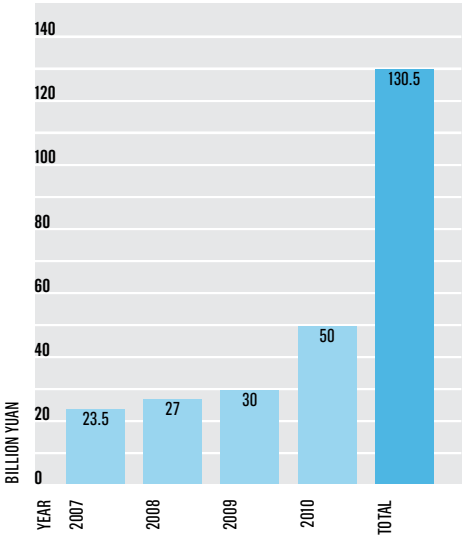


FIGURE 9

ANNUAL INVESTMENT IN ENERGY EFFICIENCY DURING THE 11TH FYP PERIOD (DATA FOR 2007-2010)[39]

Pressure was intense on local officials responsible for delivering both GDP growth and energy-efficiency improvements[40]. Consequently, the closing months of 2010 saw a last-minute rush to meet targets that resulted in socially and economically disruptive measures that included black-outs, the shutting down of residential heating and forced factory closures. This experience has challenged the government to improve its enforcement mechanisms.

Whilst energy-intensity regulation in the 11th FYP was predominantly top-down from central government, the 1000 Enterprises Program was significant in that it allowed each province to focus on enforcing energy efficiency in many dozens of companies and to ask each city in its jurisdiction to focus in turn on enforcement in a further number of companies. This devolution of targets laid the foundation for the development of more integrated-target setting, which is seen in the preparations for the current Plan.

VIII Ten Key Projects focus on key energy-efficient technologies, building conservation, green lighting and energy monitoring. The Top 1000 Energy Consuming Enterprises program set energy-savings targets for the highest energy-consuming enterprises from nine industrial sectors. Small Plant Closures focused on small and out-dated capacity in 14 high-energy-consuming industries. Appliance Standards are minimum energy performance standards for 30 appliances and types of equipment including a mandatory China Energy Label.

DRIVERS FOR CONTINUED ACTION

The government desire for a restructured economy which is cleaner and greener and which generates higher GDP per unit of energy used are embodied in the focus of the 12th FYP on demand-side energy efficiency, the shift to non-fossil fuel energy supply and the measures to promote seven strategic emerging industries (SEIs). Figure 10 outlines the four key drivers for a Clean Revolution in China. High economic growth remains at the core of the nation's strategy, balanced with the theme of 'scientific development'[IX], which recognizes the real resource constraints faced by the country. It is worth noting that the Plan also emphasizes the need to stimulate domestic consumption as a mechanism to drive growth, although it is not clear to what extent this effort will be a trade-off with energy and carbon measures.

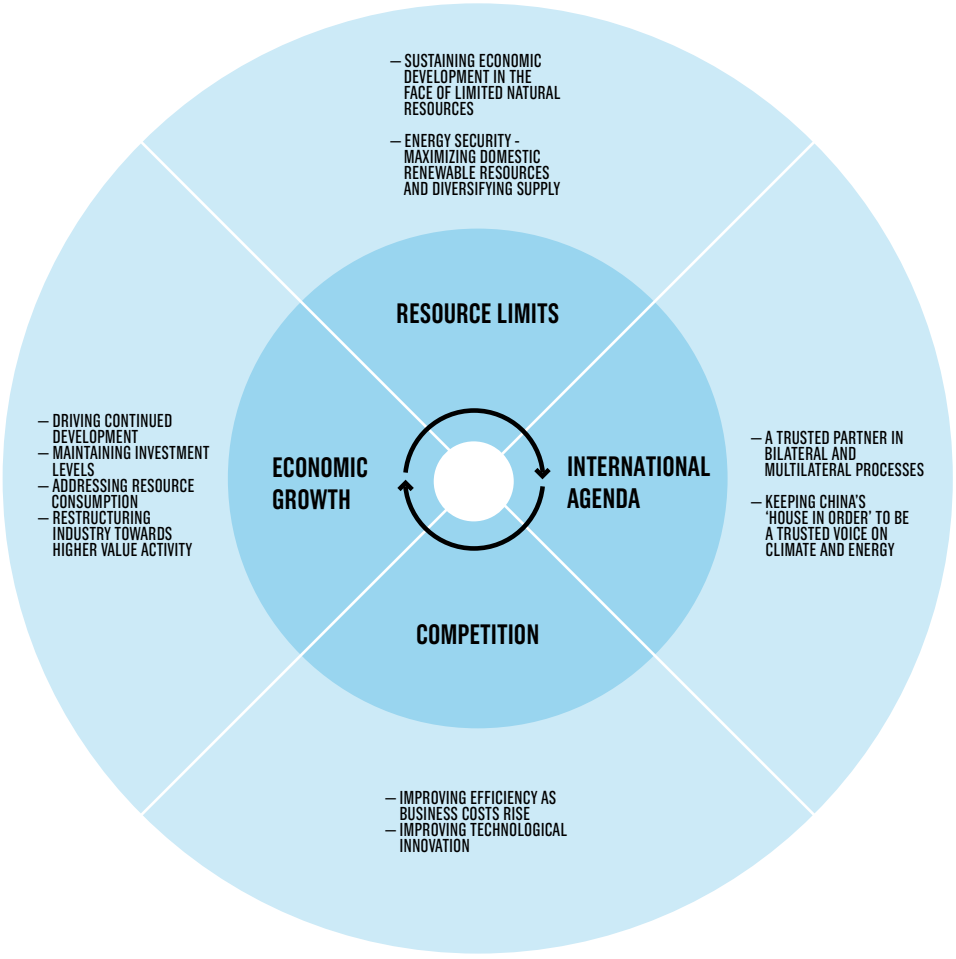


FIGURE 10
KEY DRIVERS FOR CHINA'S LOW CARBON DEVELOPMENT AGENDA[41]

Global competitiveness for China is a fundamental driver of domestic innovation in technology, which still lags behind other nations[42]. To address this, the focus on key technologies in the SEIs includes strong provisions to bolster R&D and innovation.

The final driver lies in China's rising prominence in the international community: 'keeping China's own house in order' provides the foundation for it to be a trusted voice on climate and energy.

IX 'Scientific development' (科学发展观) is the guiding socio-economic ideology of the Communist Party. Key elements are sustainable development, social welfare and the creation of a harmonious society.

TRENDS EMBODIED IN THE 12TH FYP

The 12th FYP introduces a number of changes in China's policy framework on energy and carbon emissions (Table 1), characterized by a mix of traditional command-and-control enforcement along with incentives for stronger cooperation between different levels of government and SOEs in cutting energy intensity. While central regulation will remain dominant, the next five years will be significant in the gradual inclusion of market mechanisms[43].

TABLE 1

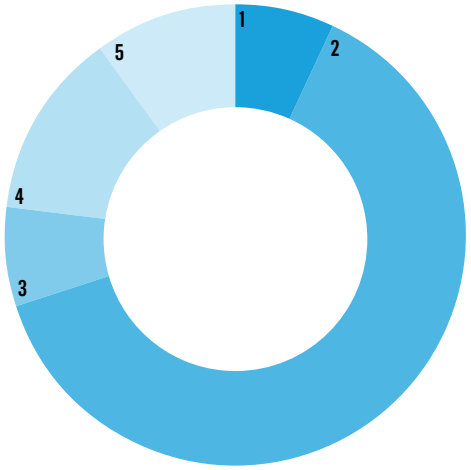
KEY TRENDS IN THE DEVELOPMENT OF CHINA'S ENERGY POLICY BETWEEN THE 11TH FYP AND 12TH FYP

POLICY AREA	11TH FIVE YEAR PLAN (2006-2010)	12TH FIVE YEAR PLAN (2011-2015)	NOTES
ENERGY INTENSITY TARGET	20% reduction	16% reduction	The slightly scaled-back target reflects learning from the 11th FYP and is to some extent consistent with diminishing returns expected from the on-going efficiency push.
CARBON INTENSITY TARGET	NOT SET	17% reduction	The new goal aligns with China's 40-45% carbon-intensity reduction target for 2020.
ROLE OF PROVINCIAL GOVERNMENT AND STATE OWNED ENTERPRISES	Primarily top-down enforcement. Targets took well over a year to set with 4-5 rounds of review[44]. Some provinces took on ambitious targets with limited co-ordination.	More focused and diverse mechanisms, stronger emphasis on devolution of targets by province and sector[45,46]; negotiating accurate GDP targets has been emphasized.	Provincial plans have been proposed. The date for finalizing plans and targets at provincial level has not yet been set.
PHASE-OUT OF INEFFICIENT INFRASTRUCTURE	Some last minute, socially disruptive shutdowns in 2010 to meet targets.	Better planned shut-downs envisaged.	Many smaller, coal-fired power plants and inefficient manufacturing facilities have already been de-commissioned[47]. There remains excess capacity in the manufacturing sector.
MARKET MECHANISMS	Limited use, although under discussion.	Increased use of market mechanisms[48]. CO_2 emissions trading pilots planned. Efforts to curb fast growing household emissions (buildings, transportation and consumer products) will be stepped up.	
ENERGY RELATED FISCAL REFORM	Under discussion only.	Identified as a priority, initial plans tabled.	
LOW CARBON TECHNOLOGIES	Individual plans developed for some low carbon technologies e.g. renewable energy.	SEIs plan proposed, taking an integrated approach to stimulating key technologies.	Whilst the SEIs are broad in definition and include some high-carbon subsectors (e.g. high-end manufacturing includes investing in aviation), the vast majority of the subsectors listed either directly target or are aligned with the creation of a low carbon economy.
ROLE OF SMALL AND MEDIUM ENTERPRISES (SMEs)	Large SOEs play primary role in developing new industries in 11th FYP and previously.	Increasing reliance on SMEs for technology development.	In June the Central Bank will release guidance to further improve financing services for SMEs together with the China Banking Regulatory Commission, China Securities Regulatory Commission and China Insurance Regulatory Commission.

SECTION 2: DRIVING DOWN CARBON INTENSITY

Low carbon technology development through the SEIs Program in the 12th FYP is essential for laying the groundwork for future emissions reductions. As many of these technologies are still at a nascent stage, however, their impact on carbon reduction before 2015 is likely to be minimal. Planned technology development under the framework of the SEIs is covered in Section 3.

This Section reviews China's plans to reduce carbon intensity. Efforts towards energy efficiency and low carbon energy will be critical for decoupling carbon emissions from China's economic growth over the next five to ten years.



EMISSIONS FROM ELECTRICITY AND HEAT GENERATION ARE ALLOCATED TO THE SECTOR CONSUMING THE ENERGY; TRANSPORT EMISSIONS ARE INCLUDED FOR COMPARISON[50]

FIGURE 11
CHINA'S CO_2 EMISSIONS FROM FOSSIL FUELS, BROKEN DOWN AT THE POINT OF ENERGY DEMAND (%)

1 REFINING, EXTRACTION AND MANUFACTURE OF FUELS	7%
2 MAUFACTURING INDUSTRIES AND CONSTRUCTION	63%
3 TRANSPORT	7%
4 RESIDENTIAL	13%
5 OTHER SECTORS	10%

ENERGY-EFFICIENCY REGULATION

The focus for improving energy intensity by 2015 continues to be on industry, which accounts for approximately 70% of China's carbon emissions (Figure 11). The priority for most plants will be to improve efficiency whilst aggressively trimming excess capacity. As previously in the 11th FYP, the most inefficient plants face closure[49].

More detailed policy proposals on efficiency are expected in the Special Energy Conservation Plan which will come from the National Development and Reform Commission (NDRC) later this year. These are expected to provide targets and guidance across sectors. It is likely that the proposals will require energy audits of large infrastructure projects and will initiate a comprehensive review of national policy with recommendations to align policies across all ministries (e.g. finance, industry, technology and economic development) in pursuit of further energy efficiency[51].

The provincial distribution of energy-intensity targets in the 12th FYP will be made more quickly and will reflect the energy-intensity experience under the 11th FYP with a very similar distribution. Unfortunately, energy data is still being collected and refined so the targets may not perfectly reflect the energy-intensity reduction capability of each province.

Further distribution amongst cities, counties and districts will be at the discretion of each province. Devolution within each province is likely to follow the strategy used in the 1000 Enterprises Program whereby each province focused on enforcing energy efficiency in dozens of companies and asked each city, in turn, to focus on a further number of companies. The NDRC is developing a guide for cities to distribute their efforts but guidance will be based on a 'typical city' by region and level of wealth.

COAL-FIRED POWER

The carbon intensity of coal-fired power stations is likely to continue to fall in the period to 2015 (Figure 12), albeit at a slightly slower rate than in the last five years[X,52]. The closure of inefficient plants will continue, with 8GW expected to be phased out during 2011[53]. In addition to eliminating inefficient plants and building ultra-super critical new plants, the electric-power industry adopted new mandatory demand-side management (DSM) regulations on January 1, 2011, which set a modest efficiency target for 2011 equivalent to 0.3% of the electricity sold the previous year. Whilst potentially significant, the program and its future targets remain unclear[54].

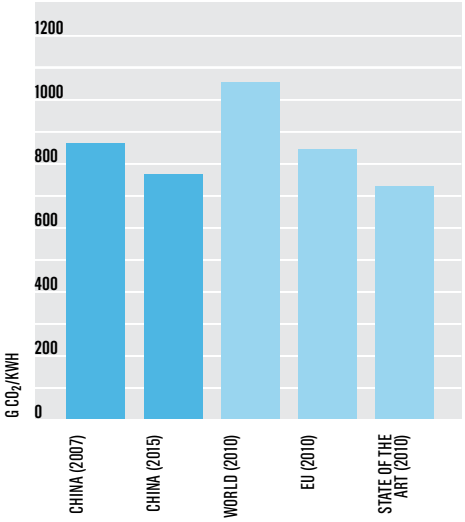


FIGURE 12
AVERAGE CARBON INTENSITY OF COAL-FIRED POWER PLANTS IN CHINA, WORLD, EU AND 'STATE OF THE ART'[55,56]

MANUFACTURING

The manufacturing sector will also be required to reduce energy intensity, with further planned shutdowns expected for plants falling short of targets. There is ample room for improvement in the sector, which still consumes on average 15-20% more energy per unit of output than the international average[57,58]. As in the 11th FYP period, the target in each industry will be to eliminate excess production capacity[59,60]. Iron, steel, nonferrous metals and building materials are especially singled out. The process is set to change, however, with 'red' and 'black-list'[XI] factories to be selected on efficiency performance as well as on excess capacity grounds. Against this backdrop, continued consolidation of industrial sectors is expected through aggressive rounds of mergers and acquisitions. Steel, for example, is projected to consolidate towards the ten largest companies controlling 60% of production (currently consolidated at 44%)[61].

BUILDINGS

The building sector is another key area for improving energy efficiency. China's retrofit program will be continued in the 12th FYP at greater scale and with the scope extended from residential to commercial buildings. The Ministry of Housing and Urban-Rural Development (MOHURD) requires that local governments install heat-measuring systems[XII] and complete energy-efficiency retrofits for 35% of residential buildings in northern provinces[XIII] by the end of the 12th FYP[62]. The government is considering a monitoring and management system for its own building stock and for large-scale commercial sites and will suggest a benchmark to define energy-efficient buildings[63]. The department responsible for energy efficiency[XIV] within MOHURD recently conducted a consultation process on the 12th FYP's provisions for building efficiency [64]. Although the details of 12th FYP for the Energy Conservation of the Building Industry have not yet been published, we can expect a better enforcement of energy-efficiency standards (e.g. improvements in the inspection methodology for buildings by adding energy efficiency to the monitoring process).

X Grams of coal per kWh fell from 345g/kWh in 2008, to 340g/kWh in 2009 and to 330g/kWh by 2015.
XI 'Red-list' companies have hitherto been selected on their meeting energy-efficiency goals only, while 'black-list' companies are those falling short of targets.
XII Heating costs have to date been determined by square feet rather than consumption of heat.
XIII Includes provinces with heating systems (Beijing, Tianjin, Hebei Province, Shanxi Province, Inner Mongolia Autonomous Region, Liaoning Province, Jilin Province, Heilongjiang Province, Shandong Province, Henan Province, Shan'xi Province, Gansu Province, Qinghai Province, Ningxia Hui Autonomous Region and Xinjiang Uygur Autonomous Region).
XIV Department of Building Energy Efficiency, Science and Technology.

MARKET MECHANISMS

China is planning to apply a range of market mechanisms to complement existing regulations and standards directed at its energy systems and carbon emissions. In this report we use the term 'market mechanism' to refer to policies where price structure (e.g. of energy, energy services or carbon emissions) is used to optimize the behaviour of energy users. This is in contrast to many aspects of China's current energy market where pricing is set by government and frequently reflects merely the price of bringing energy to the marketplace without including other costs or impacts. The key market mechanisms proposed in the 12th FYP (Table 2) include carbon emissions trading, tax reform for resources and environmental goods, energy and electricity price reform and an energy-services company (ESCO)[XV] financing model.

TABLE 2
OVERVIEW OF MARKET MECHANISMS PROPOSED IN CHINA AND THEIR ROLE IN MANAGING ENERGY SYSTEMS

TARGET/MECHANISM		PROPOSED EFFORTS TOWARDS PRICE REFORM		
	REGULATION	FIXED RATE PRICE	VARIABLE RATE PRICE	MARKET SET PRICE
INDUSTRIAL CARBON EMISSIONS	Carbon and Energy-Intensity Target	**Proposed: Carbon Tax Resource Tax Reform**	Tiered Pricing	**Carbon Trading Energy Management Business support**
INDUSTRIAL ELECTRICITY USE	Carbon and Energy-Intensity Target **DSM Regulation**	**Proposed: Carbon Tax**	Tiered Pricing	**Carbon Trading Energy Management Business support**
RESIDENTIAL ELECTRICITY USE	Fixed number of days with heating	–	**Price Ladder**	**Energy Management Business support**
RESIDENTIAL FUEL USE	Vehicle License Limit- **Stage 3 Fuel-Efficiency Standard**	Clean Energy Vehicle Subsidy	–	–
UTILITY NEW-ENERGY MIX	**New energy quota implementation**	Wind Subsidy	–	–

MECHANISMS IN BOLD TEXT ARE NEW IN THE 12TH FYP PERIOD[XVI]

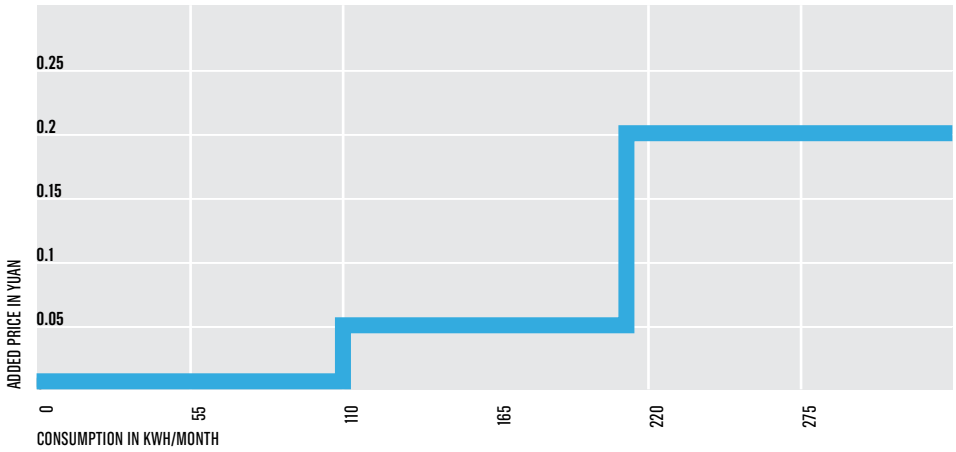
ENERGY MARKETS

Mentioned throughout the proposal for the 12th FYP is the process of rationalization and liberalization of energy pricing to match international markets. The government currently sets electricity prices for industry, businesses and residents. Evolving proposals for price reform have been on the agenda since 2002 suggesting that change will be gradual. Fuller reform is to some extent inevitable and will be central to enable supply to meet peaks in electricity demand. Fixed prices preclude Chinese power companies from profiting from demand peaks as utilities do in other countries, leading to under-investment in peak capacity.

The 12th FYP proposal tables an energy-trading market as an alternative to the centrally set prices for oil, gas and electricity but further details have not yet been provided[65]. Small changes to align energy and electricity prices are gradually being put in place, including the recently-implemented DSM program to improve the efficiency of electricity supply and a proposed 'price ladder' approach to address the demand of electricity consumers.

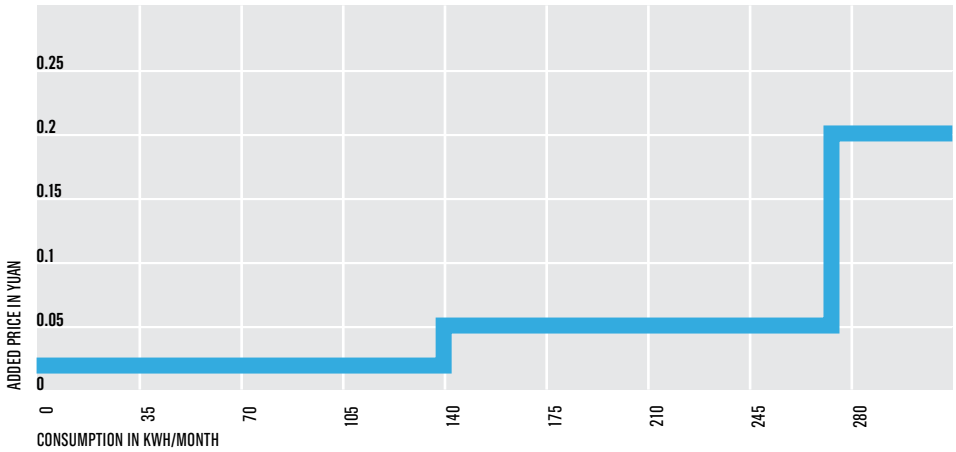
The 'price ladder' policy which is under consideration by the NDRC would set consumer prices for different levels of energy consumption. Figures 13 and 14 reflect two different options for incremental additions to the electricity price as consumption increases. The government hopes to use this approach to regulate residential energy demand and encourage efficiency[66,67].

XV Also referred to as Energy Management Contract companies (EMCs).
XVI Annex 2 gives descriptions of the proposals.



RESIDENTIAL ELECTRICITY PRICE LADDER: PROPOSAL 1

FIGURE 13
OPTION 1 FOR CONSUMER ELECTRICITY 'PRICE LADDER' PROPOSED BY THE NDRC



RESIDENTIAL ELECTRICITY PRICE LADDER: PROPOSAL 2

FIGURE 14[68]
OPTION 2 FOR CONSUMER ELECTRICITY 'PRICE LADDER' PROPOSED BY THE NDRC

TAXATION

The introduction of fiscal reform measures that use taxation and pricing in pursuit of environmental and energy goals is also set to be gradual. The initial focus is likely to be on increased subsidies and tax breaks for industries meeting energy-intensity targets. Also under consideration are gradual price increases for electricity, natural gas, water and fossil fuels to reflect social and environmental impacts.

The government is discussing a diverse suite of resource, energy and electricity taxes (outlined in Annex 2). Tax rates for energy resources like coal, which is used in energy-intensive industries, are being altered. Instead of taxation per unit of product manufactured there will be an ad valorem tax on the energy resources used to create the product, to address the need to reduce energy used rather than reducing the amount of goods produced.

A wider shift from subsidizing the 'good' (e.g. renewable energy and manufacturing energy-efficiency products) to taxing the 'bad' (fossil fuels) has been under discussion for at least six years but it is unlikely that all the proposals for price changes will be adopted before 2015. A carbon tax is even suggested by government researchers, with the recommended levy beginning at RMB 9.5 yuan/tonne CO_2 (US$1.45) and rising incrementally to between RMB 48 and RMB 390 yuan/tonne CO_2 (US$7.30 and US$59)[70].

ENERGY SERVICE COMPANIES (ESCOs)

In a further departure from the approach of central regulation, the government plans to encourage the provision of energy-efficiency services to industry through ESCOs. ESCOs use performance-based contracts with client firms to implement energy-efficiency measures, deriving revenue from the resulting cost savings. The ESCO sector is still nascent in China and dominated by a handful of companies that have hitherto been unable to meet the needs of small and medium enterprises (SMEs) in the energy-intensive industries. An ESCO policy was established in April 2010, setting out tax breaks to encourage growth in the sector.

CARBON TRADING

The province of Guangdong has recently proposed a regional cap and trade system for carbon emissions, while other provinces have proposed the establishment of a national trading platforms. In October 2010 the 17th Central Committee of the Communist Party of China (CPC) approved proposals to establish a carbon emissions trading market gradually over the next five years[71]. Two targets for 2015 are set in the 12th FYP to prepare for this – to reduce emissions intensity by 17% and energy-intensity by 16%, against 2010 levels.

China is currently assessing the relative benefits of sector-specific and economy-wide carbon trading schemes through an examination of the experience of the EU and other regions as well as through domestic pilot programs that are expected in three areas:

— Low carbon pilot regions (chosen from five nationally-recognized, low carbon provinces and eight low carbon cities[XVII], including Guangdong's proposed regional carbon-trading pilot in 11 of its cities[XVIII])
— Energy-intensive industrial sectors (such as electric power, chemicals and oil)
— SOEs[72]

Pilot regions are expected to take on caps on energy or emissions. Beyond this, details remain undisclosed and are probably undecided. It is not expected, however, that China will copy the EU Emissions Trading Scheme. Because this process will be introduced gradually over a number of years it is not likely to contribute to significant emissions reductions in the 12th FYP period.

NEW-ENERGY QUOTA SYSTEM

A quota system, already included in the Renewable Energy Law, is expected to be fully implemented during the 12th FYP period to meet the new-energy target. The quota will be based on regional development and will require energy intensive industries to acquire a certain percentage of electricity from new-energy sources as well as power companies to meet a percentage of generation capacity from 'new energy'[73].

XVII In July 2010, the NDRC selected the provinces of Guangdong, Liaoning, Hubei, Shaanxi and Yunnan and the cities of Tianjin, Chongqing, Shenzhen, Xiamen, Hangzhou, Nanchang, Guiyang and Baoding as National Low carbon Economy Pilots.

XVIII Guangdong is considered by the NDRC to have some of the best energy data in the country.

LEGISLATION

The Climate Change Law

In an effort to consolidate policies and guidance that are related to climate change, the NDRC is required to draft a new Climate Change Law (CCL) in the next two to three years. The extent to which the CCL will create new policy as opposed to drawing together existing climate-related law and regulations (e.g. the Interim Measures for the Management of CDM Project Activities, Energy Conservation Law and Renewable Energy Law) is not yet clear. However the CCL is likely to lay a legal foundation for future institutions and will standardize the functions of existing ones (such as coordination amongst ministries, planning mechanisms and the creation of industry standards). New mechanisms may include carbon trading, climate change impact evaluation for construction projects and catastrophe insurance and there may be guidance to connect with international law. Adoption of the CCL will be in the hands of the National People's Congress.

OIL CONSUMPTION AND TRANSPORT

In the transport sector, plans include building up a high-speed railway network[74] for speeds exceeding 250km/h (kilometers an hour), which is expected to reach 13,000km in 2012, up from 8,358km in 2010[75]. The Ministry of Transport (MOT) is considering a 'Special Fund' to reward selected projects that make strong progress on energy efficiency[76]. Emissions reduction in personal transportation is also emphasized in the forthcoming Stage 3 fuel-efficiency standards that will be set in 2011. This is extremely important for China's future emissions, given that China became the largest vehicle market in the world in 2010 with 18 million new cars sold. To supply those vehicles, China imported 220 million tons of crude oil in 2010, over 50% of its total oil consumption. In addition to instituting the Stage 3 fuel-efficiency standards during the next five-year period, China will further strengthen its strategic oil reserves.

SECTION 3: DRIVING LOW CARBON OPPORTUNITIES

DEVELOPMENT STRATEGIES FOR STRATEGIC EMERGING INDUSTRIES (SEIs)

A raft of plans and guidance is expected shortly covering the process by which China intends to stimulate a range of SEIs (Table 3). Whilst not exclusively so, the majority of technologies covered by China's SEI plans are low carbon. The government's plans for SEIs are expected to be key references for investment, incentive policies and funds. The central plan will be the government's SEI Development Plan, expected for release after March 2011. Jointly drafted by the NDRC in collaboration with several ministries including the Ministry of Industry and Information Technology (MIIT), the Ministry of Science and Technology (MOST), the Ministry of Finance (MOF) and the Ministry of Commerce (MOC), this document will articulate more detailed plans for each sector. In parallel, a Guiding Catalogue for Development of SEIs will identify specific technologies and sub-industries to be targeted[77]. SEI development will also be addressed in the forthcoming Guiding Catalogue for Adjustment of Industrial Structure 2011[XIX,74].

THE ROADMAP FOR SEI DEVELOPMENT

China's SEI development strategy to 2030 is expected to be based on a three-step pathway, involving a different approach depending on the stage of market development of each SEI. For example, we can anticipate a stronger focus for immature technologies on R&D and pilots while for more mature sectors on increased support for deployment (Table 3). The quantitative extents of the targets in the three-step pathway indicate the degree of ambition that there is for the growth of SEIs in China:

Step 1: Industrial added value[XX] from all SEIs to contribute 8% of GDP by 2015
Step 2: Industrial added value to contribute 15% of GDP by 2020. High-growth and mature development-stage SEIs are expected to be 'pillar industries' in the economy. Pre-commercial SEIs are to be leading growth industries
Step 3: SEIs to be 'international leaders' by 2030 (where parameters for leadership are set to include not only volume but also quality of technology, for example)[79]

XIX Guidance Catalogue for Adjustment of Industrial Structure, published annually, is a list of sectors and technologies. The Catalogue divides industries into three categories: 'encouraged,' 'restricted' and 'to be eliminated'. For restricted industries, no new investment is permitted. Those that are 'to be eliminated' are to be restructured or shut down as quickly as possible. The Catalogue is an important reference for government when approving new projects and investments. Typically, supporting industry policies come out after the release of the Adjustment Catalogue.

XX Calculated as the value of industrial outputs (before tax) minus the value of intermediate industry inputs to give the value added by the sector in question.

TABLE 3

OVERVIEW OF LOW CARBON SEI GROWTH AND INVESTMENT PLANS

SEI	EXAMPLE LOW CARBON TECHNOLOGIES	EXPECTED GROSS INDUSTRY OUTPUT	EXPECTED PUBLIC AND PRIVATE INVESTMENT
ALL SEIS	–	–	**AROUND RMB 10 TRILLION YUAN (UNCONFIRMED) OVER FIVE YEARS**
ENERGY-SAVING AND ENVIRONMENTAL PROTECTION	**Energy-saving**: efficient appliances; efficient motors; waste-to-heat boilers. **Energy services**: ESCOs. **Resource Recovery**: recycling.	**All**: RMB 4.5 trillion yuan (US$690 billion) p.a. **Energy Saving**: no data. **Energy Services**: RMB 300 billion (US$46 billion) p.a. **Resource Recovery**: no data.	No Data
NEW ENERGY	Nuclear energy Hydroelectric Solar: thermal energy, photovoltaic (PV) and concentrated solar power (CSP) Wind power Biomass and biofuels Smart grid 'Clean coal' technologies[XXI]	**All new energy**: RMB 15 trillion yuan (US$2.3 trillion) over ten years to 2020 (NB refers to value of technology sales, not energy generated).	**All new energy**: RMB 5 trillion yuan (US$760 billion) by 2020. **All renewables**: RMB 2-3 trillion yuan (US$300 billion-460 billion) by 2020. **Wind**: RMB 1.5 trillion yuan (US$230 billion) by 2020[83]. **Solar**: RMB 200-300 billion yuan (US$30 billion-46 billion) by 2020. **Smart grid**: RMB 1 trillion yuan (US$150 billion) by 2020[85]; RMB 384.1 billion yuan (US$58.48 billion) by State Grid from 2009 to 2020.
NEW-ENERGY VEHICLES	Electric vehicles (EV) Plug-in hybrids (PHEV) Fuel cell vehicles (FCEV) Energy-efficient vehicles[XXII] Advanced batteries	**New-energy vehicle targets for 2015**: 500,000 new-energy vehicles (EV, PHEV and FCEV) on the road (set by MIIT). 1 million new-energy vehicles (EV, PHEV and FCEV) on the road (set by MOST).	**Government funds to be provided by 2015**: RMB 50 billion yuan (US$7.6 billion) for R&D and industrialization. RMB 50 billion yuan (US$7.6 billion) in subsidies for consumers and infrastructure.
NEW MATERIALS	LED lighting	30% annual growth rate from 2008 to 2015; RMB 300 billion yuan (US$45 billion) p.a. by 2013 for Guangdong Province alone.	No Data
NEXT GENERATION INFORMATION TECHNOLOGY	Smart meters Digital virtualization	**Cloud computing technology**: market value estimated RMB 60.7 billion yuan (US$9 billion) by 2012. **ICT**: RMB 249 billion yuan (US$37 billion) investment for the construction of the IT service system for video content and RMB 439 billion yuan (US$67 billion) for IT services and final end-user consumption (2011-2013)[88].	(See **New Energy** for smart grid investment).

BIOTECHNOLOGY AND HIGH-END MANUFACTURING SEIS ARE NOT COVERED IN THIS REPORT

Although unconfirmed at the time of writing, the government is rumoured to be considering an investment plan for SEIs. There is, however, fervent debate whether an investment target will be set and if so, at what level. A figure of RMB 10 trillion yuan ($1.5 trillion) of public and private investment in the next five years across all SEIs has been discussed but a government target may not be set. Such investment typically comes from a mix of central funding and leveraged investment from local government, SOEs, private enterprises and financial institutions (FIs)[89]. Central government is likely to integrate and expand on funding sources already available, and we expect central investment to follow four tracks that cover the various stages of commercialization exhibited by SEIs:

— An NDRC fund supporting technology breakthrough and scale-up
— An MIIT technology fund supporting SEI companies to purchase or upgrade new equipment[90]
— MOST R&D support under the framework of the existing national 863[XXIII] and 973[XXIV] programs
— MOF funding for large-scale pilot programs and other large-scale subsidy-based programs

XXI 'Clean coal' and biofuels are not pointed out in Decision on speeding up the cultivation and development of emerging strategic industries, but are included in the drafted New-Energy Industry Plan.
XXII Energy-efficient vehicles are not included in Decision on speeding up the cultivation and development of emerging strategic industries, but are included in the drafted Energy-Efficient and New-Energy Vehicle Industry Plan.
XXIII The 863 program is the National High-tech R&D program funded by MOST (named after its March 1986 inception date).
XXIV The 973 program is the National Basic (scientific) Research Program funded by MOST.

POLICY: PUBLIC FINANCING AND FISCAL POLICY

The SEI policy package seeks in part to rectify a perceived shortfall in China's policy support for technology innovation and complements a range of existing efforts to support innovation in enterprises, research-institutes and academic settings. Key elements of the package to support innovation are outlined in Table 4.

TABLE 4

KEY ELEMENTS EXPECTED FROM CHINA'S SEI PLANS

INNOVATION AND R&D SUPPORT	— R&D funding both for national engineering laboratories and engineering centers within enterprises[91] under the government's 863 and 973 research programs[92]. — The establishment of an industry technology innovation alliance. — Provision of a general technology service platforms for SMEs with a number of geographic centers[93]. — A hi-tech sector platform including R&D, information and entrepreneurship services, as well as a series of technology exchanges[94,95].
COMMERCIALIZATION SUPPORT[96]	— Pilot programs (similar to those already in place for electric vehicle deployment). — Building up infrastructure for electric vehicles and new energy applications.
DEMAND SIDE INCENTIVES AND STANDARDS[97]	— Extending the application of consumer product energy-efficiency labels. — End-user subsidies, including direct consumer subsidies, and tax exemptions for enterprises purchasing SEI products. — Government preferential procurement policies for SEI products. — Enforcing renewable-energy portfolio standard for new energy.
MARKET MECHANISMS[98]	— Promotion of new business models (including energy service companies, recycling and re-use of waste products). — Reforming renewable energy and resource pricing mechanisms. — Accelerating the development of carbon and pollutant trading schemes.
TAX AND FISCAL SUPPORT	— Preferential tax rates for SEI companies, both domestic and foreign across all SEI sectors[XXV,99,100,101]. — Enhanced fiscal support through the establishment of specific funds. — Guidance for FIs to establish a loan-management and review system which could support the development of SEIs. A few large-scale commercial banks have already established a task force on expanding loans to SEIs. — Promoting innovation in financial services, including provisions for IP hypothecation[102]. — Continued development of the equity market, bond market, and VC/PE industries. Extending access to SEIs to private investors[103].

XXV Income tax is set at 25% for common enterprises and 15% for high-tech companies. The framework proposes an exemption for the first three years and a 50% discount on income taxes for the following three years. The government is also considering continuing with the 50% discount thereafter. For high-tech enterprises, 1.5 times R&D expenditure may be exempted from income tax.

THE ENERGY-SAVING AND ENVIRONMENTAL PROTECTION INDUSTRY

This industry includes energy efficiency, energy services, environmental-protection technologies and resource recovery/recycling[104]. Its annual gross output could grow from around RMB 1.8 trillion yuan in 2009 to RMB 4.5 trillion yuan (US$690 billion) by 2015[105,107]. We focus here on those sub-sectors that are particularly relevant to carbon emissions and that are singled out in specific plans at this stage. Environmental protection, which comprises predominantly end-of-pipe, pollution-control technologies, is therefore excluded.

RESOURCE RECOVERY

This relatively mature sub-sector reached a gross output of RMB 1 trillion yuan (US$150 billion) in 2009[108]. Rapid growth is expected in line with consumption of goods and products. The re-manufacturing industry is currently less well developed but could see similar rapid growth in the next five years based on NDRC guidance released in June 2010[109]. A new regulation on the management of end-of-life vehicles, currently at draft stage is likely to abolish an earlier requirement for sale of parts to the iron and steel sector[110], potentially leading to greater re-use of parts in new vehicles.

ENERGY SAVING: ENERGY-EFFICIENT MOTORS AND WASTE-TO-HEAT BOILERS

In the energy-saving sub-sector a number of measures target the efficiency of electric motors. In 2008, efficient products (categorized 'grade 1' or 'grade 2') accounted for only 8% of the market for small and medium-size motors[111]. Their purchase has been subsidised since June 2010 and the sale of inefficient motors ('grade 3' and below) of the same size will be prohibited after July 2011[112]. Other incentives are expected to accelerate the adoption of waste-to-heat boilers in the iron and steel industry[113,114].

ENERGY SERVICES: ESCOS

The energy-services sub-sector in China is growing rapidly, doubling its gross output between 2008 and 2010 to reach RMB 83.6 billion yuan (US$12.7 billion)[115]. The 12th FYP targets 30% annual growth to reach RMB 300 billion yuan (US$46 billion) by 2015, with ESCOs comprising half of this market[116]. A number of barriers remain for ESCO development, however, including low investment, poor client credit, low quality of energy-saving products, unsupportive business accounting practices and the generally small size of ESCO companies. The policy framework for ESCOs, however, now includes tax breaks, subsidies and clarification of some accounting items, which are expected to assist development of the sector.

NEW-ENERGY INDUSTRY

China's plan for its new-energy industry, covering advanced nuclear power, wind, hydropower, solar, biomass, clean coal, smart grid and distributed energy systems, is still under discussion[117]. Total investment (public and private) of RMB 5 trillion yuan (US$761.3 billion) is expected by 2020 and government expects the annual gross output of the sector to average RMB 1.5 trillion yuan (US$230 billion) during this period[118].

The main principles of the 12th FYP on renewable energy include:

— Hydroelectric power as the major source of renewable energy
— Wind power activity shifting from manufacture to wind farm development
— Solar energy capacity growing
— Prioritizing the diversified development of biomass

Today, there are more than 100 large-scale industrial bases for renewables nationwide. The government is planning ten key renewable-energy programs, including areas of hydroelectric-power development, a 10GW wind-development program and renewable-energy pilot cities[119].

Each new-energy area has its own investment and capacity targets for 2015.

NUCLEAR & HYDROELECTRIC POWER

Ecological and social concerns have created a period of delays in building nuclear and hydroelectric power infrastructure, but rapid growth in the next five years is expected and will help meet China's target for 15% of primary energy to be derived from non-fossil sources by 2020. New hydroelectric capacity of 63GW is planned, plus 12GW of new pumped storage[120]. The cost of dealing with environmental and social issues is likely to raise the price of hydroelectricity. As to nuclear, the government has shifted its stance from 'reasonable' development to 'making a big effort to develop' the sector; nuclear capacity is now targeted to grow fourfold to 40GW over the next five years, and will almost double again by 2020 to 70-80GW[121].

WIND

Continued growth is expected in wind generation, with a stronger focus on improving the quality of wind power rather than on increasing the number of farms. This follows a decade of rapid growth that saw China's wind capacity double every year between 2005 and 2008[122]. China's untapped wind resources are considerable. Although estimates vary, there is confidence that China could technically produce around 1.5TW (terawatt) of wind energy, mainly from on-shore resources[123]. Given that China's installed capacity was 42GW at the end of 2010[124], the potential for further expansion remains huge. The planned capacity for wind is 90GW by 2015 including 5GW from off-shore turbines, and 150GW by 2020[125]. HSBC expects that this 2020 target will be exceeded and currently forecasts capacity of over 240GW from wind by 2020[126]. These projections are aligned with estimates by the Global Wind Energy Council (GWEC) for total installed capacity to reach 115GW in 2015 and 200GW in 2020, under a moderately optimistic scenario[127]. The International Energy Agency projects capacity of only 70GW by 2020 in their reference scenario but this is considered pessimistic by GWEC, especially in the light of China's 2020 target of 150GW. Developers have highlighted the short-term constraints of the grid's capacity to deal with wind intermittency and long-distance transmission from the west of China. Nevertheless, significant investment in grid capacity is planned (outlined later in this Section) and we believe that wind growth will exceed China's targets for 2015 and 2020.

SOLAR PHOTOVOLTAIC (PV)

China's draft New-Energy Industry Plan indicates a fundamental shift in the nation's solar-PV industry from the building up of manufacturing to the steering of installations and a consolidation of the sector.

Although China was responsible for 49% of the world's solar PV production in 2009, its own installed-PV capacity was less than 2% of the world total[128]. In 2011, China is expected to increase its share of the global PV market by 10% and be the majority supplier of solar-energy devices for the first time[129]. China's push to support manufacturing has helped drive down the price of solar energy globally. This will support growing deployment within China but it has also led to excessive manufacturing of poly-silicon in the short-term. The newly released Polycrystalline Silicon Industry Access regulation aims to phase out this excess and consolidate the industry to between three and five manufacturers, a process aided by the advent of larger installations[130].

Chinese producers continue to be optimistic in spite of expected overcapacity and an unevenly-balanced supply chain. Production of PV components at the lower end of the supply chain has been challenged by a lack of investment and low technical content, which drove low profit-margins[131]. HSBC expects that while European subsidy-driven markets remain open and sizeable (which we expect that they will remain, even if a little down on 2010 in 2011), Chinese manufacturers will be encouraged to export[132].

China is targeting 5GW of PV installation by 2015[133] building on the Golden Sun Plan which led to 160MW (megawatt) installed in 2009 and projected 500MW in 2010 and 2011 respectively[134]. Domestic deployment will be slower than initially anticipated in the first part of the 12th FYP period as the government plans to spend at least one year learning from Europe's experience with subsidising solar installation[135]; in November 2010 China cancelled 39 solar projects under the Golden Sun program. Nevertheless, when China does determine how it wants to deploy solar domestically, it plans to install 20GW by 2020, taking a global leadership role in solar installation[136]. The Chinese government is expected to create 13 industrial zones to demonstrate solar energy application in order to develop the capacity for achieving its 2020 target[137]. Bloomberg New Energy Finance estimates that if China can continue to drive down prices, utility-scale PV costs could be US$1.12/W (watt) at the end of the 12th FYP down from US$2.60/W in 2010, with non-modular costs at 60% of what they are in the rest of the world[138].

GRID

Following a period when the transmission grid was a bottleneck for wind power development, the government has now emphasised grid development (Figure 15). The State Grid has announced an investment plan for 2009-2020 with provisions for RMB 384.1 billion yuan (US$58.5 billion) worth of investment in smart-grid technology (split between 30.8% for smart use, 23.2% for smart distribution and 19.5% for substations), accounting for 11% of total grid investment[139].

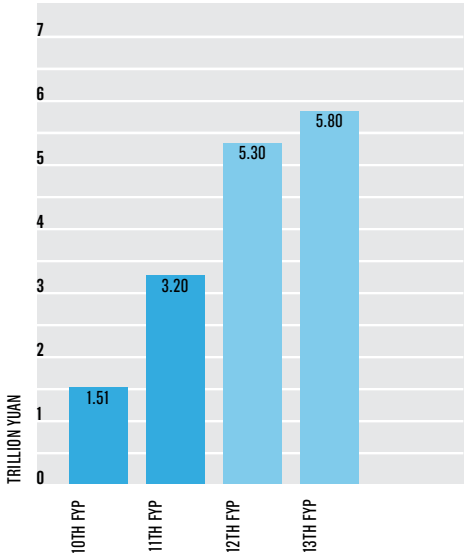


FIGURE 15
CHINA'S HISTORICAL AND PROJECTED INVESTMENT IN ELECTRIC POWER AND THE ELECTRIC GRID, 2001-2020[140,141]

'CLEAN COAL'

Because coal will be the primary fuel for China in the short to medium term, considerable emphasis is being placed on the efficiency of its use in producing energy and in avoiding the release of carbon as well as on the consolidation of the industry over the next five years. Local governments such as Shanxi and Inner Mongolia are keen to build a modern, coal chemical-industry with coal gasification and coal-to-liquids as key components, but the government's attitude is to moderate this desire and balance it with the push for sustainability[142,143]. The government aims to control the growth of the coal industry and cap annual production capacity at 3.8 billion tons by 2015, up from the current capacity of 3.2 billion. To cap growth at this level means the growth rate will need to be less than half of the rate in the 11th FYP period[144]. Whilst the coal-to-liquids investment contradicts the overall trend towards lower carbon intensity, high-efficiency and low-emission integrated gas combined cycle (IGCC) technology is also expected to continue to grow over the next ten years and this should continue to decrease the energy and carbon intensity of electricity from coal (Figure 12). The Chinese Academy of Sciences expects accumulated installation capacity to reach 20-100GW of IGCC by 2020[145]. Carbon capture and storage (CCS) continues to be an R&D priority, with an emphasis on carbon capture, utilization and storage during the 12th FYP planning period. The focus of the next five years will be the completion of the 400MW GreenGen demonstration power plant in Tianjin. Other demonstration projects will also be built, including the Clean Energy Technology Demonstration Project in Lianyungang to capture one million tons of CO_2 per year in a saline aquifer starting in 2012, along with a handful of other smaller demonstration projects[146].

NEW-ENERGY VEHICLES

In China's policy framework, New-Energy Vehicles are used to describe pure electric vehicles (EVs), plug-in hybrids (PHEVs) and fuel cell vehicles (FCEVs). Hybrid vehicles (HEVs) were recently re-categorized as 'energy-efficient' rather than 'new energy'. The energy-efficient and new-energy vehicle industry plan is still under discussion but the target for new-energy vehicles on the road by 2015 is expected to be close to two proposals – 500,000 EVs set by MIIT and one million new-energy vehicles set by MOST. These targets are modest compared to the 160 million vehicles on the road today, but should nevertheless drive the manufacturing industry to develop an increase of between five and ten million new-energy vehicles to be on the road by 2020[147,148]. Government funds of RMB 100 billion yuan (US$15.2 billion) will be provided to the industry, made up of RMB 50 billion yuan (US$7.6 billion) for R&D and industrialization and RMB 50 billion yuan (US$7.6 billion) in subsidies for consumers and infrastructure.

The new-energy vehicle pilot program has been in place for over a year but there are only several thousand EVs, PHEVs and HEVs now on the road, most of which are HEVs and buses. In six pilot cities, consumers can get a private subsidy as high as RMB 120,000 yuan (US$18,000) (from central government and local government). Although the first period of the pilot programs will end in 2012, a second pilot program period will follow. Pilots to subsidise private consumers is expected to increase to more than 20 cities by the end of 2015[149].

TABLE 5
CHINESE CAR INDUSTRY TARGETS FOR NEW-ENERGY VEHICLES

SAIC (SHANGHAI AUTO)	Maintain national leadership in the energy-efficient and new-energy vehicle industry (focusing on HEV, PHEV, EV and FCEV). 20% market share in new-energy vehicles (the same as SAIC'S current overall vehicle market share)[150]. New energy vehicle capacity target of **300,000 by 2015**[151].
GAIG (GUANGZHOU AUTO)	Annual new-energy vehicle sales target of **200,000 energy-efficient and new-energy vehicles**. (including HEV, PHEV and EV) **by 2015**[152].
CHERY	Annual new-energy vehicle sales target of **50,000 by 2015**[153].
DONGFENG	Specific **EV annual sales target of 50,000 sold by 2015**[154]. Invest RMB 3 billion yuan ($459 million) in the R&D of the new-energy vehicles[155].

Nearly all big carmakers in China have actively developed plans for new-energy vehicles (Table 5). New and smaller carmakers are also keen to lead the development of new-energy vehicles such as the Zotye 2008 EV, for example, well known as the first BEV on the road in China[156]. It is expected that, in new joint ventures that have to do with new-energy vehicles between domestic and international carmakers, joint R&D will replace the current system of importing technologies from international companies. Lithium ion (Li-ion) batteries are of particular focus for joint venture R&D to match international technology with China's ability to drive down cost and increase manufacturing efficiency. The cost of Li-ion batteries manufactured in China is expected to drop to below RMB 2 yuan/Wh (watt hour) (US$0.30/Wh) from the current RMB 3-6 yuan/Wh (US$0.50-0.90/Wh) over the next five years[157]. Additionally, the quality of Li-ion battery production in China continues to range widely.

To support EV-industry targets, State Grid and Southern Grid are currently building an EV-recharging network. State Grid plans to invest RMB 14 billion yuan (US$2.1 billion) in the 12th FYP period and another RMB 18 billion yuan (US$2.7 billion) in 13th FYP period. By 2015, there will be 4,000 charging stations and the start of a network of charging poles and in 2020 there will be 10,000 charging stations and a complete network of charging poles[158]. As a result of the city, grid and car industry targets the EV parts and recharging equipment market is expected to grow quickly at all levels in the next five years.

LED INDUSTRY

The light emitting diode (LED) lighting industry is listed as a sub-industry of the New Materials industry in the SEI catalogue. It is expected to grow rapidly in the next five years as the price of chips falls. Applications for growth are expected to include street lighting, indoor lighting in the retail and hospitality sectors and the car industry. Road lighting applications will continue to expand in certain places over the next five years. The annual installation of units reached 160,000 in 2009[159] rising to 350,000 units in 2010, and another 500,000 units are expected to be installed in 2011[160]. The leading LED-industry center in China is Guangdong where the gross output value of the LED-lighting industry was RMB 39 billion yuan (US$5.9 billion) in 2009, and it is likely that it will have reached RMB 80 billion yuan (US$12 billion) in 2010 and 300 billion yuan ($45.7 billion) in 2013. Many cities in the Pearl River Delta region have been aggressive in developing the LED industry, with second-tier cities typically most aggressive in their deployment goals. Shanghai and Beijing are expected to hesitate in the large-scale deployment of LEDs until the price of chips is less expensive, which is likely to drive deployment by 2013-2015.

The central government will use LEDs in government building retrofits and is likely to transfer its current financial and policy support from T5, T8 and compact fluorescent lights to LEDs in building-retrofit lighting projects. The government will encourage LEDs to be included in ESCO offerings when using public funds, following on the Guangdong Green Investment Fund's example of using the ESCO model and public funds to pay for LED deployment. After 2012, LEDs are likely to be inexpensive enough to include in many ESCO offerings.

GEOGRAPHIC DISTRIBUTION

Most provinces have already submitted their regional SEI plans to the central government. Regions have chosen their SEI-industry focus based on their existing industry strengths and have chosen a variety of industries. For example, Jiangxi province includes ten SEI subcategories in its development plan, including tungsten applications; solar-PV manufacturing; aerospace manufacturing; biochemistry; 'green' food; new-energy vehicles and batteries; culture and creativity; LED and 'green' lighting; non-metal new materials; copper applications; and nuclear and wind power energy efficiency. Comparing the plans from different regions, there are four common approaches for fiscal and financial support by the local government:

— Specified funds
— Preferential tax rates
— Financial system reform to favor industry areas
— Initiating and funding pilot demonstration programs

It is worth noting that when regional governments plan for SEIs there is limited regional co-ordination and balance, posing a potential risk for industry development between the provinces[161].

IMPLICATIONS

The contribution of SEIs to the carbon and energy-intensity targets in the 12th FYP is difficult to quantify. The products or technologies of several SEIs will directly or indirectly contribute to the mitigation of climate change. Some industries with relatively mature technologies, especially the energy-efficiency and environmental-protection industry and the new-energy industry, will provide a higher contribution in the near term. For other, less-mature technologies such as EVs, where manufacturing rather than deployment of EVs is the short-term priority of the Chinese government, the mitigation impact will be minimal in the next five years.

SECTION 4: PROSPECTS AND NEXT STEPS

Our view is that whilst the policies contain some trade-offs and must be viewed in the context of China's overall drive for growth and development, the new energy and low carbon technology development elements of the 12th FYP constitute leadership in the field. If successful, China's efforts on new energy, energy efficiency and gas-fired generation will also reduce the carbon intensity of the economy by 17% and avoid 0.83Gt of CO_2 emissions over the next five years (Figure 16). The rate of growth in coal still presents the most significant challenge from a climate change perspective. Success against the plans will be determined by a number of factors. Historically, China has exceeded some targets (e.g. GDP growth and wind energy deployment) and fallen short on others (hydroelectric and nuclear power). In this Section we assess China's prospects for delivering the Plan, key challenges and the next steps expected from the government.

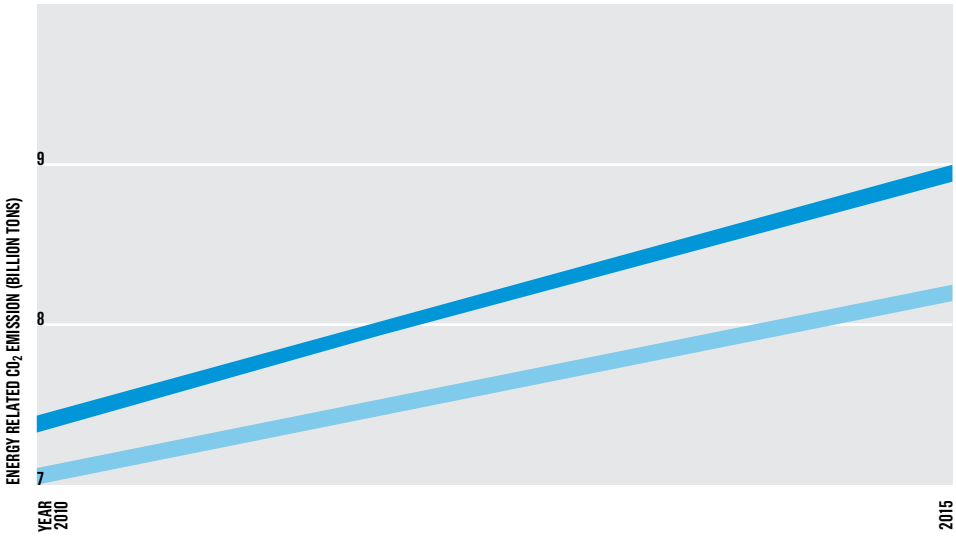


FIGURE 16
ESTIMATED EMISSIONS AVOIDED IF CARBON INTENSITY TARGET OF 17% FOR THE 12TH FYP IS REACHED, AGAINST IEA CURRENT POLICIES SCENARIO REFERENCE[XXVI,162]

HOW REALISTIC ARE THE TARGETS?

The main targets for energy and GDP growth in the 12th FYP compared to targeted and actual growth in the previous five years are presented in Figure 17. The internal negotiations around GDP and energy targets in the 12th FYP were intense. Previously found to be too conservative, the main power demand and industrial growth projections that formed the basis of planning were re-forecast late in the process[163]. The revised projections set primary energy consumption to grow to 4.0Gtce (gigatonne standard coal equivalent) by 2015[164] with power generation capacity to reach 1.437TW in the same time frame (equivalent to an 8.5% annual growth rate)[165].

XXVI The IEA reference scenario refers to energy-related emissions only, whereas the 12th FYP carbon-intensity target (17%) anticipates emissions reductions achieved through afforestation. Here, we apply the 17% to China's energy-related emissions, given that the associated 12th FYP energy-intensity target is 16% and the new-energy percentage is expected to increase over the five-year period (i.e. energy-related carbon intensity will decline proportionally faster than energy intensity).

Figure 17 shows that electricity demand is expected to grow more slowly than in the 11th FYP[166] and the actual rate will be largely dependent on GDP growth, targeted at 7% per annum.

Whilst GDP growth itself has consistently outstripped projections (GDP is currently expected to grow at 7-8%, close to the targeted 7%[167]), estimates suggest that even if the actual rate were as high as 9.5%, reductions in energy intensity of 4.1% annually (18.8% over five years) and carbon intensity of 3.9% annually (18.0% over five years) would still be realistic[168].

FIGURE 17
KEY ENERGY AND CLIMATE POLICY GOALS AND INDICATORS IN CHINA 2006–2020

	11TH FYP (2006-2010) (TARGET)	11TH FYP (ACTUAL)	**12TH FYP (2011-2015) (TARGET)**	13TH FYP (2016-2020) (TARGET)
INDICATORS				
ENERGY INTENSITY (% REDUCTION IN FIVE YEARS)	20%	19.1%	**16%**	NOT SET
CARBON INTENSITY (% REDUCTION IN FIVE YEARS)	NOT SET		**17%**	40-45% VS 2005
NEW ENERGY (% OF PRIMARY ENERGY)	10%	9.6%[1]	**11.4%**	15%
GROWTH RATES				
PRIMARY ENERGY CONSUMPTION (ANNUAL GROWTH)	4%	6.3%	**3.75-5%***	–
ELECTRICITY ENERGY CONSUMPTION (ANNUAL GROWTH)	–	11%	**8.5%***	(5.5%)*
ELECTRICITY GENERATING CAPACITY (ANNUAL GROWTH)	8.4%*[2,3]	13.2%[4]	**8.5%***	(5.6%)*
GDP (ANNUAL GROWTH)	7.5%	10.6%	**7%**	–

NUMBERS WITH ASTERISKS INDICATE GOVERNMENT ESTIMATES THAT ARE NOT FORMAL TARGETS. BOLD NUMBERS ARE NEW GOVERNMENT TARGETS.

With the challenges faced during the 11th FYP period, the general consensus appears to be that the 12th FYP targets are achievable for the following reasons:

— Previous experience – China achieved a 19.1% energy-intensity reduction during the 11th FYP.
— Excess capacity of 15-25% remains in the manufacturing system[173] – phasing out the continuing over-capacity in many energy-intensive industries will improve industrial energy intensity overall.
— Energy efficiency has a more complete policy, funding and investment framework in place, with a budding energy-services industry and the introduction of market mechanisms such as the residential-energy 'price ladder'.
— Delays in rolling out hydroelectric and nuclear power are expected to be overcome in the next five years as the grid improves and as other environmental and social concerns are addressed by mitigation measures (potentially entailing a higher cost of energy from these technologies).
— Stronger planning – local governments previously reported GDP targets to central government with limited review and dialogue. Going forward the central government will review, guide and approve targets, balancing local government ambition for unbridled GDP growth.

Based on IEA's estimate that China is on track for 1Gt of carbon abatement by 2020, the economist Zhongxiang ZHANG (East-West Centre) has calculated that a 43.6% cut in carbon intensity for 2005-2020 is well within the range of China's stated 40-45% target. Building on top of the policies existing in 2010 and the forthcoming 12th FYP policies, Zhang believes a cut of 46-50% in carbon intensity is possible in the same period. Such a reduction would surpass IEA's target for China in its 450ppm Scenario for 2020, with abatement slightly greater than 1Gt relative to the reference scenario (9.6Gt CO_2 emissions in 2020)[174].

CHINA'S PLANS ON LOW CARBON ENERGY ARE IN LINE WITH INTERNATIONAL EXPECTATIONS

China's 'new energy'targets compare favorably with the IEA's World Energy Outlook 2010 scenario for stabilizing atmospheric concentrations of CO_2 at 450ppm by 2100, suggesting that China is 'pulling its weight' with regard to building low carbon power generation (Figure 18). Actual progress will inevitably vary from the targets but we believe that low carbon electricity deployment will be on or ahead of target.

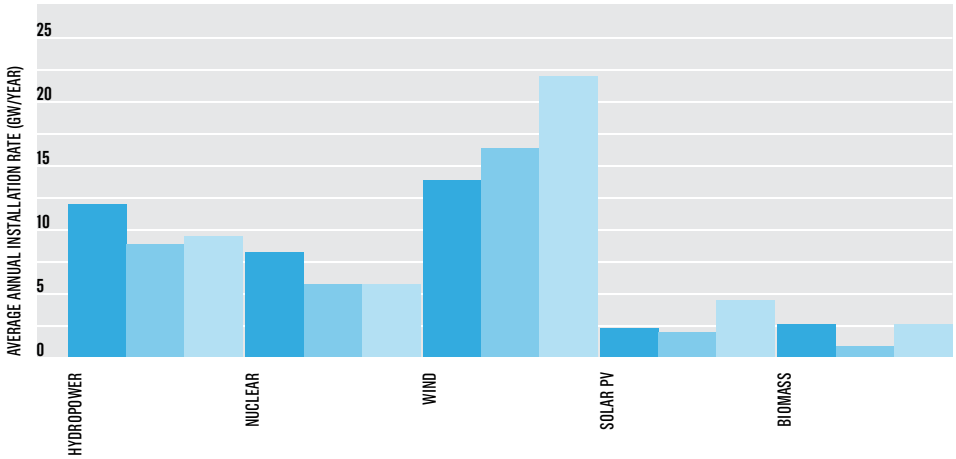


FIGURE 18
CHINA'S LOW CARBON TARGETS COMPARED TO IEA'S 450PPM SCENARIOS AND HSBC'S ESTIMATES[13] OF ACTUAL ANNUAL DEPLOYMENT ANNUALLY, 2010-2020

CHINA'S TARGETS
IEA'S WORLD ENERGY OUTLOOK 2010 450PPM SCENARIO
HSBC ESTIMATES

WHAT ARE THE PRIMARY BARRIERS TO SUCCESS?

The major barriers encountered in the 11th FYP period will in many respects continue into the next five years, and there will be short and medium-term challenges as well as longer-term challenges.

SHORT AND MEDIUM-TERM CHALLENGES

- **Conflicts between industry plans and provincial economic plans** tied to energy-intensive industries with energy-intensity targets still exist. The conflict between GDP growth and energy intensity is most visible in the early and middle-stage industrialization of the Midwest region of China. Provinces in this region, such as Qinghai and Guizhou, will have very challenging energy-intensity targets. This may present short-term difficulties but early consultation with provinces in this planning cycle will to some extent mitigate this.
- Enforcement of policies at all levels remains a problem because of **limited continuous oversight, lack of energy data** and **minimal real-time punitive measures** for violation of guidelines and regulations. These issues continue to improve, however, and should present less of a barrier than in the 11th FYP period.
- **Lack of capacity and experience** with energy efficiency, energy data management and the financing of energy efficiency. The transition from the 'visible hand' of the government to the 'invisible hand' of the market is unlikely to be a smooth process.
- **The increasing role of natural gas.** Projected to reach 6% - 8.3% of primary energy in 2015 , gas remains cheaper than alternatives. If new gas capacity substitutes for nuclear and renewables it could limit the proportion of non-fossil fuel energy in the generation mix.
- **Large-scale industrial growth rates.** The Chinese Academy of Social Sciences believes that over the next two years the economy is not likely to slow down and that the investment rate in large-scale industry could grow rapidly, especially in Midwestern provinces. Some commentators believe that large-scale industrial growth could exceed 20% per annum during the 12th FYP period. As this sector accounts for approximately 70% of China's total energy consumption and since there is still an excess of up to a quarter of industrial capacity after five years of concerted effort to close this down, meeting the energy-intensity target will not be without challenges.

LONGER-TERM CHALLENGES

— **Chinese financing does not flow well to non-SOEs** despite abundant capital. Many companies have limited opportunity to implement energy-efficiency projects without shutting down production capacity. A number of barriers are at play, including conservative bank-lending policies and government policies and bidding processes that favor SOEs[177]. This presents a longer-term barrier – shut-downs and consolidation will be a more important driver of intensity improvements in the short term.
— Irrational **energy pricing** and the need for electricity-price reform presents a longer-term challenge to the meeting of targets. The 12th FYP acknowledges these challenges and proposals have been on the table since 2002 – implementation will be important for optimizing the behaviour of energy generators and users.

OPPORTUNITIES FOR FOREIGN ENTERPRISES

The new SEI focus is likely to mean more opportunities for foreign investors and enterprises. Although foreign enterprises will continue to be excluded from independent involvement in national R&D programs, they will be encouraged to apply jointly with domestic enterprises. In addition, while national pilots now only involve indigenous products, this requirement is expected to be phased out[178]. China has recently announced moves to strengthen its intellectual property regime under the 12th FYP as this becomes an increasingly significant issue for its own domestically-derived IP. The extent to which this will impact on the experience of foreign-owned enterprises operating in China, however, is not clear. The 'collaborative competition' theme will continue as Chinese SOEs continue to globalize, including an increased rate of acquisition of technology capabilities overseas[179]. The government is encouraging SEI enterprises to create IP alliances and has recognized the need to provide enforcement mechanisms to strengthen existing laws and regulation for intellectual property.

KEY MILESTONES IN THE NEXT FIVE YEARS

The 12th FYP is not a stand-alone document that determines the course of the next five years. The process of planning, setting targets, monitoring success and adjusting is continuous. In the last two years (in a process that will continue over the course of the next year) specific industry plans and provincial targets have been submitted to the central government, negotiated, discussed and agreed upon. The following are a few key milestone plans to look out for during the 12th FYP:

— **The Special Energy Conservation Plan** is expected from the NDRC later in 2011.
— **The Specific Plan for Addressing Climate Change** will break down the restricting indicators, including energy intensity, carbon intensity, non-fossil-fuel percentage and forest coverage. With drafting begun on January 12, this plan is expected to come out during this year[180].
— The **SEIs Development Plan**, which will be a guiding document for SEIs, is expected to be released after March.
— The **Energy-Efficient and New-Energy Vehicle Industry Plan**, which was expected to come out by the end of 2010, is still under discussion.
— The **New-Energy Industry Plan**, which is still under discussion.
— A new **Climate Change Law** which is expected in two to three years is likely to draw together existing climate-related law (e.g. Interim Measures for the Management of CDM Project Activities, Energy Conservation Law and Renewable Energy Law), to lay a legal foundation for future institutions, and to standardize the functions of existing institutions.
— The **Energy Law** will be the basic law for energy in China. The draft Energy Law was released for public comment in 2007 and was submitted to the State Council in 2010[181].

CONCLUSIONS

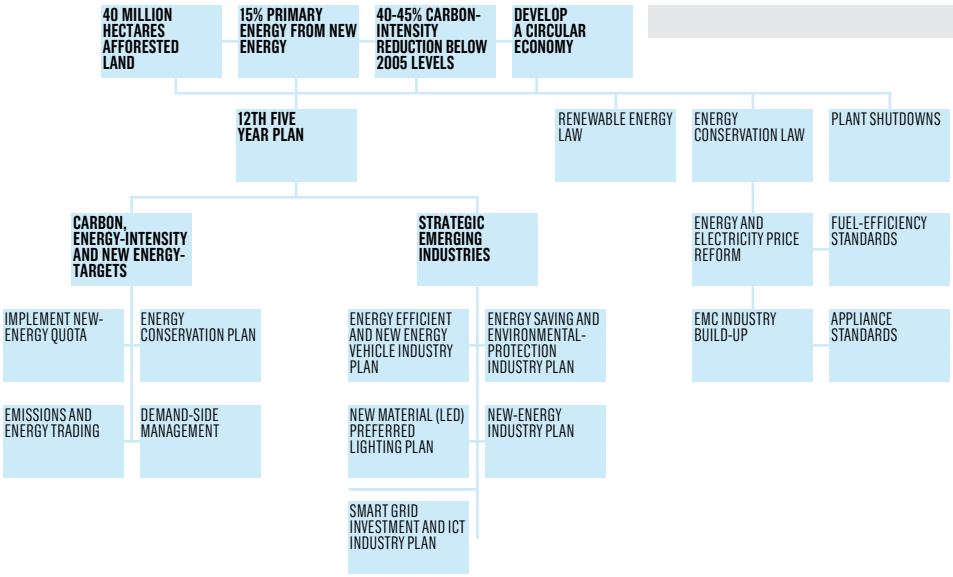
The information available on the 12th FYP shows that China is working to continue its leadership in pursuit of a Clean Revolution in its economy. Furthermore, the government's plans on new energy power generation are broadly in line with international expectations articulated by the IEA, suggesting that China is 'pulling its weight' on new energy and intends to reap the benefits of increased competitiveness and energy diversity in the process. From the perspective of climate change, the 12th FYP is strong in many areas but could be further strengthened through a clear plan on CCS, solar deployment (especially concentrated solar power) and greater clarity on transport, particularly EVs. Central to China's ability to peak carbon emissions around the end of the decade, however, will be success in reducing the growth in China's energy demand. This will come from efficiency in buildings and energy intensive industry, and through restructuring the economy towards higher value activity.

China's Plan is not without contradictions, inconsistencies, omissions and major challenges. However the consensus appears to be that it will successfully meet its climate-related targets for 2015. The policy mechanisms at China's disposal are becoming more sophisticated and are based on previous learning, but capacity at the local level to implement new approaches is likely to remain an issue.

The Plan is, of course, not all-encompassing and policy development in China remains dynamic. More detail on implementation will be released in the next 12 months and parallel processes on domestic climate policy will continue to move ahead. We will continue to track the main developments and we advise those interested in low carbon business in China to continue to watch this space.

ANNEX 1

CLIMATE AND ENERGY POLICY IN THE 12TH FYP PERIOD

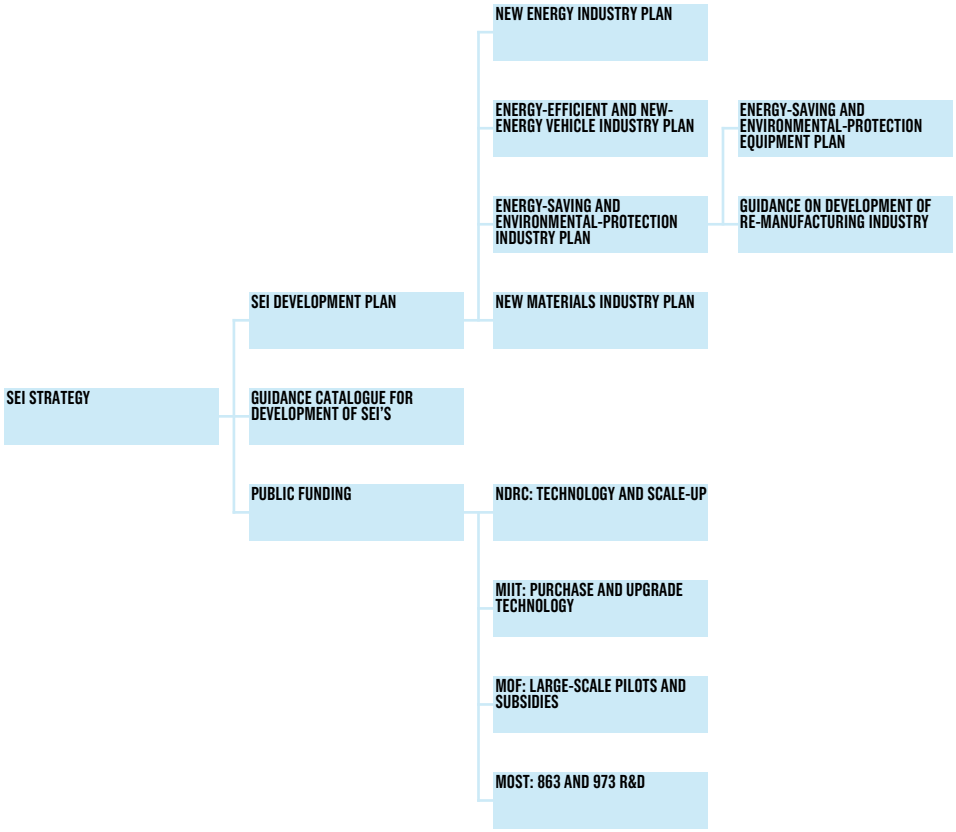


ANNEX 2

SUMMARY OF CHINA'S MAIN ENERGY POLICY MECHANISMS

POLICY MECHANISM	DESCRIPTION
NEW-ENERGY QUOTA MANAGEMENT IMPLEMENTATION	The details will be part of the 2011 National Energy Board work plan. Is likely to require renewables as a percentage of either (a) power company generation or (b) energy-intensive industry purchasing.
SPECIAL ENERGY CONSERVATION PLAN	Expected from the NDRC later in 2011. Likely to be the most significant proposal for delivering against efficiency goals. Likely features include an energy audit requirement for large infrastructure projects.
CLIMATE CHANGE LAW	Expected in the next five years (draft expected from NDRC in 2-3 years). Will lay a legal foundation for future institutions and standardize functions of existing institutions (e.g. coordinating amongst ministries, planning mechanisms, creating industry standards). May draw together policies already in force including CDM guidelines and energy conservation laws.
IMPACT INDICATORS	Indicators established in the 12th FYP include new energy, energy savings, pollution, carbon intensity and energy intensity[182].
CONSOLIDATION OF ENERGY INTENSIVE INDUSTRY	Consolidation, mergers and acquisitions expected to intensify in the 12th FYP. Especially relevant for energy-intensive industries like steel. The coal sector will reduce from 11,000 to 7,000 companies with 6-8 large enterprise groups.
ENVIRONMENTAL TAX	Enacted as early as 2011, starting with SO2 and waste water. Introduction will be gradual. Conservative revenue estimates from environmental taxes (including on carbon) are in the range of RMB 1 billion yuan (US$150 billion)[183].
CARBON TAX	A possibility in the next five years. Recommendations start with a levy at RMB 9.5 yuan/tonne (US$1.45) and rising incrementally to between RMB 48 and 390 yuan/tonne (US$7.30 to US$59).
ENERGY PRICE LADDER	Proposed for residential electricity, setting per-unit price according to three stepped levels. Around 70-80% of residents will maintain existing prices but higher-consuming residents will be charged at higher rates.
EMISSIONS AND ENERGY-EFFICIENCY TRADING	Announced by CPC Central Committee in October 2010, with intent to 'gradually establish' a carbon emissions trading market. The government is currently assessing sector-specific and economy-wide schemes. Guangdong has proposed a pilot between its 11 cities and the electricity industry is also expected to be involved in tests.
ENERGY TRADING MARKET	Mentioned in the 12th FYP, but without details on which energy sources would be included. Central government currently sets the price for oil, gas and electricity. Coal prices have become more market-oriented. Domestic oil prices are far below the international price of oil. Natural gas and industrial electricity prices are close to US levels[184,185].
STRATEGIC EMERGING INDUSTRY PLANS	Included in the 12th FYP to stimulate seven broad sectors to boost efficiency, competitiveness and industrial added value. There is a wide array of mechanisms to promote R&D and commercialization. Detailed plans are involved.
DEMAND-SIDE MANAGEMENT	Mandatory 0.3% energy-efficiency target established in January 2011 for the electric power industry. The target for 2011 is equivalent to a 0.3% efficiency improvement on electricity sold in 2010.

ANNEX 3



THE ROADMAP FOR STRATEGIC EMERGING INDUSTRY DEVELOPMENT

REFERENCES

1 Wang, Youling (December 15, 2010). China's renewable energy contributes to 9.6% of total energy consumption (in Chinese). Xinhua News Agency. Retrieved February 15, 2011 from www.gov.cn/jrzg/2010-12/15/content_1766566.htm.
2 CEC (September 10, 2006). CEC released 2005 power industry statistic report (in Chinese). CEC. Retrieved February 15, 2011 from www.cec.org.cn/nengyuanyudianlitongji/hangyetongji/2010-11-28/30070.html.
3 Xie, Zhenhua (September 30, 2009). Power industry 10th FYP review and 11th FYP perspective (in Chinese). CEC. Retrieved February 15, 2011 from http://info.electric.hc360.com/2006/09/30080952891-2.shtml.
4 Zheng, Xiaoyi (January 7, 2011). CEC: China's power capacity reached 962GW in 2010 (in Chinese). Xinhua News. Retrieved February 15, 2011 from http://news.xinhuanet.com/fortune/2011-01/17/c_12988305.htm?finance.
5 Premier Wen Jiabao. (2011). Address to National People's Congress (anticipated at the time of going to print).
6 ibid.
7 Ma, Jiantang (January 20, 2011). National economic situation is generally good in 2010 (in Chinese). State Statistics Bureau. Retrieved January 20, 2011 from www.stats.gov.cn/tjfx/jdfx/t20110120_402699441.htm.
8 Calculated based on business as usual assumptions and calculations from: Lynn, Price et al. (2011). Assessment of China's Energy-Saving and Emission-Reduction Accomplishments and Opportunities During the 11th Five Year Plan. Lawrence Berkeley National Laboratory and Azure International. Retrieved February 15, 2010 from http://china.lbl.gov/sites/china.lbl.gov/files/ACEStudy.2011.pdf.
9 International Energy Agency (2010). CO2 Emissions from Fuel Combustion, Highlights. IEA. Retrieved January 24, 2011 from www.iea.org/co2highlights/co2highlights.pdf.
10 Xu, Bo et al. (June 1, 2010). An analysis of Chinese carbon dioxide mitigation strategy. Royal Institute of Technology, Sweden. Retrieved February 15, 2010 from www.kadinst.hku.hk/sdconf10/Papers_PDF/p263.pdf.
11 Energy Research Institute, NDRC. (2011). Unpublished internal research.
12 International Energy Agency. (2010). World Energy Outlook.
13 Robins, Nick et al. (September 2010). Sizing the climate economy. HSBC Global Research.
14 Wang, Youling (December 15, 2010). China's renewable energy contributes to 9.6% of total energy consumption (in Chinese) Xinhua News Agency. Retrieved February 15, 2011 from www.gov.cn/jrzg/2010-12/15/content_1766566.htm.
15 Xing, Baiying (November 3, 2010). 12th FYP hydropower target: 63GW capacity will be installed by 2015 (in Chinese). China Securities Journal. Retrieved February 15, 2011 from http://news.xinhuanet.com/fortune/2010-11/03/c_12731518.htm.
16 Liu, Weixun (January 12, 2011). Energy Bureau officer: will speed up the hydro power construction and increase the power electricity price (in Chinese). Economic Observer Newspaper. Retrieved February 15, 2011 from www.eeo.com.cn/industry/energy_chem_materials/2011/01/12/191319.shtml.
17 National Energy Bureau (July 21, 2010). Energy Bureau's media release to introduce energy and economic trend in the second half of 2010 (in Chinese). China.com.cn. Retrieved February 15, 2011 from www.china.com.cn/policy/txt/2010-07/21/content_20540104.htm.
18 National Energy Bureau (July 21, 2010). Energy Bureau's media release to introduce energy and economic trend in the second half of 2010 (in Chinese). China.com.cn. Retrieved February 15, 2011 from www.china.com.cn/policy/txt/2010-07/21/content_20540104.htm.
19 Li Jufeng (January 2011). Presentation at CREIA Annual Meeting. Chinese Renewable Energy Industry Association. Retrieved February 20, 2011 from www.creia.net/.
20 Ordos Coal Bureau (January 12, 2011). National energy and economy working session: Transfer the energy development model, enhance the supply and guarantee ability, and build up a safe, stable, economic and clean modern energy industry system (in Chinese). Ordos Coal Bureau. Retrieved February 15, 2011 from www.ordos.gov.cn/pub/ordosmt/hydt/201101/t20110112_277848.html.
21 ibid.
22 ibid.
23 National Energy Bureau (July 21, 2010). Energy Bureau's media release to introduce energy and economic trend in the second half of 2010 (in Chinese). China.com.cn. Retrieved February 15, 2011 from www.china.com.cn/policy/txt/2010-07/21/content_20540104.htm.

24 Xing, Baiying (November 3, 2010). 12tb FYP hydro power target: 63GW capacity will be installed by 2015 (in Chinese). China Securities Journal. Retrieved February 15, 2011 from http://news.xinhuanet.com/fortune/2010-11/03/c_12731518.htm.
25 CEC (Feb 23, 2011). Statistic report of China's power industry 2010. CEC. Retrieved Mar 5, 2010 from http://www.cec.org.cn/tongjixinxibu/tongji/niandushuju/2011-02-23/44236.html.
26 Lv, Ruixian (Nov 13, 2011). Natural gas power: to accelerate the development but not to leap forward. China Economic Herald. Retrieved Mar 5, 2011 from http://www.ceh.com.cn/ceh/jryw/2010/11/13/71271.shtml.
27 China Energy Research Observer Net. National Energy Bureau officials interpret 12th FYP energy plan and development priorities (in Chinese). China Energy Research Observer Net. Retrieved February 15, 2011 from www.chinaero.com.cn/rdzt/2010_nyjjfz/zxdt/2010/11/69857.shtml.
28 Xinhua news agency. (November 23, 2010). China spends 1.7% of GDP on R&D. China Daily. Retrieved March 1, 2011 from www.chinadaily.com.cn/business/2010-11/23/content_11594970.htm.
29 Xiao, Ming and Li, Jiaofeng (April 29, 2010). The R&D investment indicator will increase in 12th FYP (in Chinese). 21st Century Business Herald. Retrieved February 15, 2011 from www.21cbh.com/HTML/2010-4-29/3NMDAwMDE3NDk3NA.html.
30 International Energy Agency (2010). CO_2 Emissions from Fuel Combustion, Highlights. IEA. Retrieved January 24, 2011 from www.iea.org/co2highlights/co2highlights.pdf.
31 Zhu Songli. (January 2011). Low Carbon Policies and Measures in China. ERI. Presented at IGES-ERI policy dialogue: low carbon development in Asia – models, measures and applications, Beijing, China.
32 Guo, Jiangwen and Zusman, Eric. (December 2010). Working Paper: Negotiating a Low Carbon Transition in China: Aligning Reforms and Incentives in the 12th Five Year Plan. IGES. Presented at IGES-ERI policy dialogue: low carbon development in Asia – models, measures and applications, Beijing, China.
33 State Electricity Regulatory Commission of China. (2010). 2009 Power Generation Bulletin (in Chinese). Retrieved February 15, 2011 from www.serc.gov.cn/zwgk/jggg/201012/t20101202_13869.htm.
34 Qin, Feifei (November 25, 2011). Resource reform will be carried out during 12th FYP together with more policy incentives to encourage emissions reduction (in Chinese). Shanghai Securities News. Retrieved February 15, 2011 from http://paper.cnstock.com/html/2010-11/25/content_64443.htm.
35 Calculated based on: Levine et al. (January 2011). Assessment of China's Energy-Saving and Emission-Reduction Accomplishments and Opportunities During the 11th Five Year Plan. China Energy Group, Lawrence Berkeley National Laboratory and Azure International. Retrieved January 20, 2011 from http://china.lbl.gov/sites/china.lbl.gov/files/ACEStudy.2011.pdf.
36 International Energy Agency. CO_2 Emissions from Fuel Combustion, Highlights. IEA website. Retrieved January 24, 2011 from www.iea.org/co2highlights/co2highlights.pdf.
38 Levine et al. (January 2011). Assessment of China's Energy-Saving and Emission-Reduction Accomplishments and Opportunities During the 11th Five Year Plan. China Energy Group, Lawrence Berkeley National Laboratory and Azure International. Retrieved January 20, 2011 from http://china.lbl.gov/sites/china.lbl.gov/files/ACEStudy.2011.pdf.
39 Liu, Xin (September, 2010). China's experience of financing energy efficiency (in Chinese). Energy and Environmental Development Research Centre. Retrieved February 15, 2011 from www.unece.org/se/pp/eneff/Astana_EEForum_Sep2010/d1s2_2_LiuXin.pdf.
40 State Council Information Office (SCIO) (November 23, 2010). SCIO hosted press release on China's addressing of climate change (in Chinese). SCIO. Retrieved February 15, 2011 from www.scio.gov.cn/xwfbh/xwbfbh/wqfbh/2010/1123/.
41 The Climate Group analysis.
42 Yu, Dawei (November 6, 2010). Wang Gang: National innovation ability is close to moderately developed country (in Chinese). Caixin Online. Retrieved February 15, 2011 from http://policy.caing.com/2010-11-06/100196209.html.
43 Qin, Feifei (November 25, 2011). Resource reform will be carried out during 12th FYP together with more policy incentives to encourage emissions reduction (in Chinese). Shanghai Securities News. Retrieved February 15, 2011 from http://paper.cnstock.com/html/2010-11/25/content_64443.htm.
44 Zhu Songli. (January 2011). Low Carbon Policies and Measures in China. ERI. Presented at IGES-ERI policy dialogue: low carbon development in Asia – models, measures and applications, Beijing, China.
45 Shao, Xiaotian (October 29, 2010). New indicator will be used to shut down inefficiency capacity during 12th FYP (in Chinese). China Business News. Retrived February 15, 2011 from www.yicai.com/news/2010/10/583471.html.
46 Gao, Dongsheng (January 17, 2011). Industry energy-efficiency from indicator to demand (in Chinese). China Economic Weekly. Retrieved February 15,2011 from http://green.sohu.com/20110117/n278912308.shtml.
47 General Office of MIIT (Now 30, 2010). Miao Wei addressed on second China city energy-efficiency summit (in Chinese). MIIT. Retrieved February 15, 2011 from www.miit.gov.cn/n11293472/n11293832/n11293907/n11368223/13512668.html.
48 Guo, Jiangwen and Zusman, Eric. (December 2010). Working Paper: Negotiating a Low Carbon Transition in China: Aligning Reforms and Incentives in the 12th Five Year Plan. IGES. Presented at IGES-ERI policy dialogue: low carbon development in Asia – models, measures and applications, Beijing, China.
49 Shao, Xiaotian (October 29, 2010). New indicator will be used to shut down inefficiency capacity during 12th FYP (in Chinese). China Business News. Retrived February 15, 2011 from www.yicai.com/news/2010/10/583471.html.
50 Levine et al. (January 2011). Assessment of China's Energy-Saving and Emission-Reduction Accomplishments and Opportunities During the 11th Five Year Plan. China Energy Group, Lawrence Berkeley National Laboratory and Azure International. Retrieved January 20, 2011 http://china.lbl.gov/sites/china.lbl.gov/files/ACEStudy.2011.pdf.
51 Xie, Zhenhua (November 24, 2011). Accelerate the construction of long term mechanism matching socialist market economy (in Chinese). NDRC. Retrieved February 15, 2011 from http://news.xinhuanet.com/2010-11/24/c_12811785.htm.
52 State Electricity Regulatory Commission of China. (2010). 2009 Power Generation Bulletin (in Chinese). Retrieved February 15, 2011 from www.serc.gov.cn/zwgk/jggg/201012/t20101202_13869.htm.
53 Tang, Qiong (April 6, 2009). To speed up shutting down inefficient coal-fired plants: 31GW will be closed in next three years (in Chinese). China Energy News. Retrieved February 15, 2011 from http://paper.people.com.cn/zgnyb/html/2009-04/06/content_229279.htm.
54 Ng, Jessica and Tom Rowlands-Rees. (July 21, 2011). China takes first steps towards tradable efficiency? Energy Smart Technologies- Analyst Reaction. Bloomberg New Energy Finance.
55 China Electricity Council (February, 2010). Guidebook for power sector to address climate change (in Chinese). CEC and The Climate Group.
56 VGB Powertech. (2010). Electricity Generation Facts and Figure. VGB. Retrieved February 6, 2011 from www.vgb.org/en/data_powergeneration.html.
57 Jiang, Kejun. (2010). Energy-Efficiency Improvement in China: Significant Progress for the 11th Five Year Plan. Energy Research Institute, NDRC.
58 Shao, Xiaotian (October 29, 2010). New indicator will be used to shut down inefficiency capacity during 12th FYP (in Chinese). China Business News. Retrieved February 15, 2011 from www.yicai.com/news/2010/10/583471.html.
59 Jiang, Kejun. (2010). Energy-Efficiency Improvement in China: Significant Progress for the 11th Five Year Plan. Energy Research Institute, NDRC.
60 Shao, Xiaotian (October 29, 2010). New indicator will be used to shut down inefficiency capacity during 12th FYP (in Chinese). China Business News. Retrieved February 15, 2011 from www.yicai.com/news/2010/10/583471.html.
61 Yang, Ye (January 26, 2011). Steel Industry 12th FYP emerges (in Chinese). Economic Information. Retrieved February 15, 2011 from http://dz.jjckb.cn/www/pages/webpage2009/html/2011-01/26/content_22234.htm?div=-1.
62 MOF and MOHURD. (2011). Notification of promoting the heating management and energy-efficiency retrofit of existing residential buildings in northern regions with heating (in Chinese). Retrieved February 15, 2011 from www.mohurd.gov.cn/lswj/tz/t20110128_202232.htm.
63 Ma, Lin (January 18, 2011). Building energy-efficiency quota for 12th FYP is considered (in Chinese). China Real Estate Business. Retrieved February 15, 2011 from http://km.focus.cn/news/2011-01-18/1170095.html.
64 MOF and MOHURD. (2011). Notification of promoting the heating management and energy-efficiency retrofit of existing residential buildings in northern regions with heating (in Chinese). Retrieved February 15, 2011 from www.mohurd.gov.cn/lswj/tz/t20110128_202232.htm.
65 Central Committee of the Communist Party of China (CPC). (2010). CPC Central Committee's Proposal for 12th Five Year Plan (in Chinese). Retrieved February 15, 2011 from http://news.xinhuanet.com/politics/2010-10/27/c_12708501.htm.
66 NDRC. (2010). Guidance to carry out ladder price for residential electricity (in Chinese). Retrieved February 15, 2011 from www.ndrc.gov.cn/jtdjyj/qwll/t20101008_374091.htm.
67 NDRC (October 9, 2010). NDRC officer answers questions about the residential ladder electricity price (in Chinese). NDRC. Retrieved February 15, 2011 from www.ndrc.gov.cn/jtdjyj/qwll/t20101008_374091.htm.
68 ibid.
70 Guo, Jiangwen and Zusman, Eric. (December 2010). Working Paper: Negotiating a Low Carbon Transition in China: Aligning Reforms and Incentives in the 12th Five Year Plan. IGES. Presented at IGES-ERI policy dialogue: low carbon development in Asia – models, measures and applications, Beijing, China.
71 Central Committee of the Communist Party of China (CPC). (2010). CPC Central Committee's Proposal for 12th Five Year Plan (in Chinese). Retrieved February 15, 2011 from http://news.xinhuanet.com/politics/2010-10/27/c_12708501.htm.
72 Zhang, Yidong (February 23, 2010). Three possible approaches for carbon trading during 12th FYP (in Chinese). Caijing Online. Retrieved February 15, 2011 from www.caijing.com.cn/2010-12-23/110600841.html.
73 Hua, Yan (May 10, 2010). Government will implement the quota policy to push the development of renewable energy (in Chinese). Sina. Retrieved February 15, 2011 from http://finance.sina.com.cn/chanjing/cyxw/20100510/23027908873.shtml.
74 Central Committee of the Communist Party of China (CPC). (2010). CPC Central Committee's Proposal for 12th Five Year Plan (in Chinese). Retrieved February 15, 2011 from http://news.xinhuanet.com/politics/2010-10/27/c_12708501.htm.
75 National Bureau of Statistics (March 4, 2011). The 7th sub-report of social and economic development achievements in 11th FYP: big progress was made in transportation sector. National Bureau of Statistics. Retrieved March 4, 2011 from www.stats.gov.cn/tjfx/ztfx/sywcj/t20110304_402707886.htm.
76 Zhu, Jialin. (January 16, 2010). 12th FYP perspective: trend for low carbon economy – transportation sector (in Chinese). Speech delivered at the China low carbon economy forum, Beijing, China.
77 Wang, Yingchun (February 11, 2011). SEIs development Plan (framework) is approved (in Chinese). Shanghai Securities News. Retrieved February 15, 2011 from www.cnstock.com/index/gdbb/201102/1144743.htm.
78 Feng, Li (December 24, 2010). New Guidance Catalogue for Adjustment of Industrial Structure will come out early next year (in Chinese). Caijing Online. Retrieved February 15, 2011 from www.caijing.com.cn/2010-12-24/110601806.html.
79 State Council. (2010). Decision on speeding up the cultivation and development of emerging strategic industries (in Chinese). Retrieved February 15, 2011 from www.gov.cn/zwgk/2010-10/18/content_1724848.htm.
82 ibid.
83 ibid.
84 ibid.
85 Xu, Weixuan (March 11, 2010). Trillions of investment: the vehicle of smart grid starts (in Chinese). 21st Century Business Herald Retrieved February 15, 2011 from www.21cbh.com/HTML/2010-3-12/168279.html.
86 NDRC et al. (2009). Guidance on the development of LED lighting industry (in Chinese). Retrieved February 15, 2011 from www.sdpc.gov.cn/zcfb/zcfbtz/2009tz/t20091012_306445.htm.
87 CCIDC Consulting (2010). White paper of China's cloud computing industry (in Chinese). CCIDC Consulting. Retrieved February 15, 2011 from http://tech.ccidnet.com/zt/cwb/images/cloudbook.pdf.

88 Xu, Jieyun (November 3, 2010). The integration of telecommunications networks, cable TV networks boost 688 billion market (in Chinese). National Business Daily. Retrieved February 15, 2011 from www.chinadaily.com.cn/hqgj/jryw/2010-11-03/content_1129474.html.
89 Xu, Yi Sheng & Li, Dongchao (February 6, 2010). Debate about 10 trillion: policies for SEIs are coming up (in Chinese). China Business News. Retrieved February 15, 2011 from www.yicai.com/news/2010/12/618834.html/
90 ibid.
91 ibid.
92 State Council. (2010). Decision on speeding up the cultivation and development of emerging strategic industries (in Chinese). Retrieved February 15, 2011 from www.gov.cn/zwgk/2010-10/18/content_1724848.htm.
93 ibid.
94 Huang, Mingming (August 17, 2010). Hi-tech service industry is becoming new highlight for development of China's economy (in Chinese). Science Times. Retrieved Feb15, 2011 from http://news.sciencenet.cn//sbhtmlnews/2010/8/235692.html?id=235692.
95 NDRC. (2010). Notification to promote the development of hi-tech service industry (in Chinese). Retrieved February 15, 2011 from www.gov.cn/gzdt/2010-07/26/content_1664062.htm.
96 State Council. (2010). Decision on speeding up the cultivation and development of emerging strategic industries (in Chinese). Retrieved February 15, 2011 from www.gov.cn/zwgk/2010-10/18/content_1724848.htm.
97 ibid.
98 ibid.
99 Chen, Yanpeng & Zhang, Zhi (November 20, 2011). Income tax might be halved for 7 SEIs, and the supportive plan has been submitted to authority department (in Chinese). China Times. Retrieved February 15, 2011 from http://tech.sina.com.cn/it/2010-11-20/00544888232.shtml.
100 General Office of State Council (February 11, 2007). Three departments interpret Implementation Regulation for Enterprise Income Tax Law of the People's Republic of China (in Chinese). State Council. Retrieved February 15, 2011 from www.gov.cn/zwhd/2007-12/11/content_830568.htm.
101 MOF & State Taxation Administration. (2008). Notification of enterprise income tax exemption related to technology innovation (in Chinese). Retrieved February 15, 2011 from www.most.gov.cn/ztzl/gjzctx/ptzcssjl/200802/t20080225_59272.htm.
102 State Council. (2010). Decision on speeding up the cultivation and development of emerging strategic industries (in Chinese). Retrieved February 15, 2011 from www.gov.cn/zwgk/2010-10/18/content_1724848.htm.
103 Xin, Hua (February 9, 2011). International cooperation is in the ascendant (in Chinese). International Business Daily. Retrieved February 15, 2011 from http://e.ibdaily.com.cn/news.php?id=33619.
104 Wang, Xiaoming (November 25, 2010). The development plan of an energy-efficiency and environmental-protection industry is approved (in Chinese). 21st Century Business Herald. Retrieved February 15, 2011 from www.21cbh.com/HTML/2010-11-26/2NMDAwMDIwNzg2Ng.html.
105 Gao, Na (May 6, 2010). Environmental protection industry: 900 billion market is ready (in Chinese). 21st Century Business Herald. Retrieved February 15, 2011 from www.21cbh.com/HTML/2010-5-7/wOMDAwMDE3NjEwOQ.html.
107 Yu, Lan (November 8, 2009). The gross output value of the energy-efficiency and environmental-protection industry will reach 4.5 trillion RMB in 2012 (in Chinese). China News Service. Retrieved February 15, 2011 from www.chinanews.com/cj/cj-cyzh/news/2009/11-08/1952855.shtml.
108 Chen, Yuming and Ye, Jian (April 22, 2010). The gross output value reached one trillion last year (in Chinese). Xinhua News. Retrieved February 15, 2011 from www.chinanews.com/ny/news/2010/04-22/2242613.shtml.
109 NDRC. (2010). Guidance on Development of the Re-manufacturing Industry (in Chinese). Retrieved February 15, 2011 from www.ndrc.gov.cn/zcfb/zcfbtz/2010tz/t20100531_350189.htm.
110 Zhao, Peinan (October, 2010). The barrier of resource recycling and re-use industry will be overcome (in Chinese). China Investment. Retrieved February 15, 2011 from www.cnmn.com.cn/ShowNews.aspx?id=187319&page=1.
111 Xu, Zheng (June 11, 2010). Break the ice: the promotion of energy-efficient electric motors (in Chinese). Power News. Retrieved February 15, 2011 from www.gkong.com/html/news/2010/6/48640.html.
112 Guo, Yu (July 13, 2010). New energy-efficiency regulation is released: energy-efficient motor will be subsidised (in Chinese). China Industry News. Retrieved February 15, 2011 from http://218.247.239.222/wzgk/wy/210049.shtml.
113 MIIT. (2010). Scheme for Promoting the Sinter Waste Heat Power Generation Technology in Iron and Steel Enterprises (in Chinese). Retrieved February 15, 2011 from www.miit.gov.cn/n11293472/n11293832/n11293907/n11368223/12980945.html.
114 State Council. Several suggestions on further promoting energy efficiency and emissions reduction and accelerating the iron and steel industry structure adjustment (in Chinese). Retrieved February 15, 2011 www.gov.cn/zwgk/2010-06/17/content_1629386.htm.
115 Ni, Guanghui abd Hou, Lijun (January 31, 2011). The gross output value of energy-efficiency service industry will reach 300 billion in 12th FYP (in Chinese). People Online. Retrieved February 15, 2011 from http://politics.people.com.cn/GB/1026/13727725.html.
116 ibid.
117 National Energy Bureau (July 21, 2010). Energy Bureau's media release to introduce energy and economic trend in the second half of 2010 (in Chinese). China.com.cn. Retrieved February 15, 2011 from www.china.com.cn/policy/txt/2010-07/21/content_20540104.htm.
118 Han, Xiaodong (August 8, 2010). The new-energy industry plan will target five trillion investment (in Chinese). China Securities News. Retrieved February 15, 2011 from www.cs.com.cn/xwzx/jsbd/201008/t20100808_2543355.htm.
119 Yang, Yihua (September, 2010). Five trillion: the 10 year's appointment (in Chinese). ChinaSOE. Retrieved February 15, 2011 from www.qikan.com.cn/Article/guoq/guoq201009/guoq20100917.html.
120 Xing, Baiying (November 3, 2010). The 12th FYP target for hydroelectric power: 63GW newly installed by 2015 (in Chinese). Xinhua News. Retrieved February 15, 2011 from http://news.xinhuanet.com/fortune/2010-11/03/c_12731518.htm.
121 Zhan, Ling (October 20, 2010). Hydro, nuclear and wind are preferred; solar is still under argument (in Chinese). 21st Century Business Herald. Retrieved February 15, 2011 from www.21cbh.com/HTML/2010-10-21/5MMDAwMDIwMjA5Mw.html.
122 REN21. (October 2009). Background Paper: Chinese Renewables Status Report. Retrieved March 1, 2011 from www.ren21.net/Portals/97/documents/Publications/Background_Paper_Chinese_Renewables_Status_Report_2009.pdf.
123 ibid.
124 GWEC and Greenpeace. (2010). Global Wind Energy Outlook 2010. Pg 7. Retrieved March 1, 2011 from www.gwec.net/fileadmin/documents/Publications/GWEO%202010%20final.pdf.
125 Zhan, Ling (October 20, 2010). Hydro, nuclear and wind are preferred; solar is still under argument (in Chinese). 21st Century Business Herald. Retrieved February 15, 2011 from www.21cbh.com/HTML/2010-10-21/5MMDAwMDIwMjA5Mw.html.
126 Clover, Robert et al. (13 December 2010). Low carbon China: peering through the smog at a cleaner future. HSBC Global Research.
127 GWEC and Greenpeace. (2010). Global Wind Energy Outlook 2010. Pg 7. Retrieved March 1, 2011 from www.gwec.net/fileadmin/documents/Publications/GWEO%202010%20final.pdf.
128 REN21. (2010). Renewables 2010 Global Status Report. Retrieved March 1, 2011from www.ren21.net/Portals/97/documents/GSR/REN21_GSR_2010_full_revised%20Sept2010.pdf.
129 BNEF. (February 14, 2011). China Profits from Solar-Power Strategy as Europeans Backpedal. Retrieved March 1, 2011 from http://bnef.com/News/43833 (access to article requires subscription).
130 Li, Yongqiang (February 22, 2010). Meng Xiangan: domestic demand should become a focus of PV industry development in future (in Chinese). China Energy News. Retrieved February 15, 2011 from www.chinanews.com/ny/2010/12-22/2737877.shtml.
131 Ernst & Young. (2011). Renewable Energy Country Attractiveness Indices. Retrieved March 1, 2011 from www.ey.com/Publication/vwLUAssets/Renewable_energy_country_attractiveness_indices_-_Issue_28/$FILE/EY_RECAI_issue_28.pdf.
132 Clover, Robert et al. (13 December 2010). Low carbon China: peering through the smog at a cleaner future. HSBC Global Research.
133 Zhang, Qian (October 22, 2010). The target of energy 12th FYP is preliminary settled down (in Chinese). Caijing Magazine. Retrieved February 15, 2011 from www.caijing.com.cn/2010-10-22/110549714.html.
134 Li, Yongqiang (February 22, 2010). Meng Xiangan: domestic demand should become a focus of PV industry development in future (in Chinese). China Energy News. Retrieved February 15, 2011 from www.chinanews.com/ny/2010/12-22/2737877.shtml.
135 BNEF. (February 14, 2011). China Profits from Solar-Power Strategy as Europeans Backpedal. Retrieved March 1, 2011 from http://bnef.com/News/43833 (access to article requires subscription).
136 ibid.
137 Ernst & Young. (2011). Renewable Energy Country Attractiveness Indices. Retrieved March 1, 2011 from www.ey.com/Publication/vwLUAssets/Renewable_energy_country_attractiveness_indices_Issue_28/$FILE/EY_RECAI_issue_28.pdf.
138 BNEF. (February 14, 2011). China Profits from Solar-Power Strategy as Europeans Backpedal. Retrieved March 1, 2011 from http://bnef.com/News/43833 (NB: access to article requires subscription).
139 Chen, Chenjian (January 5, 2011). Smart grid: broad market prospects (in Chinese). Guosen H&S. Retrieved February 15, 2011 from http://tianjin.chinadaily.com.cn/hqcj/zgjj/2011-01-05/content_1515815.html.
140 Long, Zhihui (Fev 27, 2010). CEC released the research outcome of power industry 12th FYP (in Chinese). China Energy News. Retrieved February 15, 2011 from http://paper.people.com.cn/zgnyb/html/2010-12/27/content_709298.htm.
141 ibid.
142 Wang, Xiuqiang (September 1, 2010). The policy of coal chemistry will tighten up in 12th FYP (in Chinese). 21st Century Business Herald. Retrieved February 15, 2011 form www.21cbh.com/HTML/2010-9-1/xMMDAwMDE5NTIxMA.html.
143 Li, Xiqiong (November 25, 2011). The development mode of coal chemistry industry should be shifted (in Chinese). China Economic Times. Retrieved February 15, 2011 from www.chinanews.com/ny/2010/11-25/2680001.shtml.
144 Zhang, Na (October, 2010). 12th FYP starts: the competition between new and old energies (in Chinese). Energy Magazine. Retrieved February 15, 2011 from www.chinanews.com/ny/2010/12-06/2702563.shtml.
145 Wang, Hui and Zhao, Lifeng (September 13, 2010). IGCC is a key energy-efficiency and emissions reduction technology and should be supported by policy (in Chinese). Scientific Times. Retrieved February 15, 2011 from http://news.sciencenet.cn//sbhtmlnews/2010/9/236686.html?id=236686.
146 The Department of Social development and the Administrative Centre for China's Agenda 21. (July 2010). Carbon Capture, Utilisation and Storage Development in China (in Chinese). Ministry of Science and Technology.
147 NetEase (September 21, 2010). Draft version of energy-efficiency and new-energy vehicle industry plan (Full text) (in Chinese). NetEase. Retrieved February 15, 2011 from http://auto.163.com/10/0921/14/6H447G4M00084JS5.html.
148 Tencent reporter (November 7, 2010). O'yang Minggao: three steps of new-energy vehicle scale-up in 12th FYP (in Chinese). Tecent. Retrieved February 15, 2011 from http://auto.qq.com/a/20101107/000068.htm.
149 NetEase (September 21, 2010). Draft version of the energy-efficiency and new-energy vehicle industry plan (Full text) (in Chinese). NetEase. Retrieved February 15, 2011 from http://auto.163.com/10/0921/14/6H447G4M00084JS5.html.
150 He, Jianghua (October 25, 2010). SAIC new-energy vehicle target: 20% of market share (in Chinese). Guangzhou Daily. Retrieved February 15, 2011 from http://auto.qq.com/a/20101025/000049.htm.

151 Liu, Changrong (December 31, 2010). SAIC started to make effort on industrialisation of new-energy vehicles (in Chinese). Shanghai Capital. Retrieved February 15, 2011 from http://finance.sina.com.cn/leadership/mroll/20101231/17459194251.shtml.
152 Tencent reporter (November 6, 2010). Huang Xiangdong: GAIG targets 200,000 annual new-energy vehicle sales by the end of 12th FYP (in Chinese). Tencent. Retrieved February 15, 2011 from http://auto.qq.com/a/20101106/000124.htm.
153 Bitauto (January 6, 2011). Chery targets annual sales of two million (in Chinese). Bitauto. Retrieved February 15, 2011 from http://news.bitauto.com/others/20110106/1105274113-8.html.
154 Tencent reporter (Aug12, 2010). Dongfeng Group released energy-efficient and new-energy vehicle strategy (in Chinese). Tencent. Retrieved February 15, 2011 form http://hb.qq.com/a/20100812/001837.htm.
155 ibid.
156 Zhang, Yu (August 12, 2009). Without fuel tank and accelerator: the first BEV got license in China (in Chinese). Hangzhou Online. Retrieved February 15, 2011 from http://auto.sohu.com/20090812/n265889921.shtml.
157 NetEase (September 21, 2010). Draft version of energy-efficiency and new-energy vehicle industry plan (Full text) (in Chinese). NetEase. Retrieved February 15, 2011 from http://auto.163.com/10/0921/14/6H447G4M00084JS5.html.
158 Xing, Mei (November 26, 2010). Investment on EV recharging infrastructure will exceed 10 billion in next five years (in Chinese). Economic Information News. Retrieved February 15, 2011 from www.chinadaily.com.cn/hqcj/zgjj/2010-11-26/content_1282357.html.
159 LEDinside (November 26, 2009). LEDinside: the area of supportive policy shifts, LED road lighting demand is less than 300,000 in 2009 (in Chinese). LEDinside. Retrieved February 15, 2011 from www.ledinside.com.tw/ledinside_pre_china_market_led_streetlights.
160 LEDinside (January 24, 2011). 500,000 units of road lighting will be installed in 2011 in China (in Chinese). LEDinside. Retrieved February 15, 2011 from www.ledinside.com.tw/news_china_led_20110120.
161 Geng, Yanbing (November 4, 2010). Local government: SEIs are similar in different provinces (in Chinese). 21st Century Business Herald. Retrieved February 15, 2011 from www.21cbh.com/HTML/2010-11-4/xMMDAwMDIwNDUxMg.html.
162 Energy Research Institute, NDRC. (2011). Unpublished internal research.
163 Ding, June (February 29, 2010). MIIT: the industrial growth rate target in 12th FYP is lowered to 11% (in Chinese). 21st Century Business Herald. Retrieved February 15, 2011 from http://nf.nfdaily.cn/epaper/21cn/content/20101229/ArticelJ06003FM.htm.
164 China Energy Research Observer Net. National Energy Bureau officials interpret 12th FYP energy plan and development priorities (in Chinese). China Energy Research Observer Net. Retrieved February 15, 2011 from www.chinaero.com.cn/rdzt/2010_nyjjfz/zxdt/2010/11/69857.shtml.
165 Long, Zhihui (Fev 27, 2010). CEC released the research outcome of power industry 12th FYP (in Chinese). China Energy News. Retrieved February 15, 2011 from http://paper.people.com.cn/zgnyb/html/2010-12/27/content_709298.htm.
166 ibid.
167 Premier Wen Jiabao. (2011). address to National People's Congress.
168 Dalian Evening News. Energy-intensity target decrease to 16%: mid and western area still difficult to reach (in Chinese). Dalian Evening News. Retrieved February 15, 2011 from http://xb.21cbh.com/HTML/2010-12-20/yOMDAwMDIxMTUyOA.html.
169 Xie, Zhenhua (September 30, 2009). Power industry 10th FYP review and 11th FYP perspective (in Chinese). CEC. Retrieved February 15, 2011 from http://info.electric.hc360.com/2006/09/30080952891-2.shtml.
170 CEC (September 10, 2006). CEC released 2005 power industry statistic report (in Chinese). CEC. Retrieved February 15, 2011 from www.cec.org.cn/nengyuanyudianlitongji/hangyetongji/2010-11-28/30070.html.
171 Zheng, Xiaoyi (January 7, 2011). CEC: China's power capacity reached 962GW in 2010 (in Chinese). Xinhua News. Retrieved February 15, 2011 from http://news.xinhuanet.com/fortune/2011-01/17/c_12988305.htm?finance .
172 ibid.
173 Jiang, Kejun. (2010). Energy-Efficiency Improvement in China: Significant Progress for the 11th Five Year Plan. Energy Research Institute, NDRC.
174 Zhang, Zhongxiang. (January 2011). Assessing China's Carbon-Intensity Pledge for 2020: Stringency and Credibility Issues and their Implications. Presented at IGES-ERI policy dialogue: low carbon development in Asia – models, measures and applications, Beijing, China.
175 Robins, Nick et al. (September 2010). Sizing the climate economy. HSBC Global Research.
176 Zhang, Na (October, 2010). 12th FYP starts: the competition between new and old energies (in Chinese). Energy Magazine. Retrieved February 15, 2011 from www.chinanews.com/ny/2010/12-06/2702563.shtml.
177 The Climate Group research.
178 Tecent reporter. Wan Gang speech: EVs from different countries could benefit from the subsidy. Tecent. Retrieved February 15, 2011 from http://auto.qq.com/a/20101107/000028.htm.
179 Daniel, Schäfe. (January 18, 2011). China and Germany: Reflected Glory. Financial Times. Retrieved March 1, 2010 at www.ft.com/cms/s/0/2cd6dcac-233c-11e0-b6a3-00144feab49a.html#axzz1FPCtGeMo.
180 Wang, Yingchun (January 13, 2011). Plan addressing climate change is likely to come out in this year, sector carbon emission pilot is considered (in Chinese). China Securities News. Retrieved February 15, 2011 from www.chinadaily.com.cn/hqcj/zgjj/2011-01-13/content_1566248.html.
181 Wang, You (February 17, 2010). Four years' revision: the legislation process Energy Law will speed up? (in Chinese). First Financial Daily. Retrieved February 15, 2011 form www.yicai.com/news/2010/02/314847.html.
182 Liang, Min (January 19, 2011). Six low carbon indicators will be brought up for 12th FYP (in Chinese). Shanghai Securities News. Retrieved February 15, 2011 from http://finance.qq.com/a/20110119/000698.htm.
183 Wang, Erde et al. (February 9, 2010). Environmental tax will have four categories, still arguments on tax rates (in Chinese). 21st Century Business Herald. Retrieved February 15 from www.21cbh.com/HTML/2010-12-10/2MMDAwMDIxMDI2Mw.html.
184 Zheng, Houqing and Lu, Xiaoyan (August 7, 2009). The energy price ratio: the real picture under the price iceberg (in Chinese). State Grid Economic & Technology Research Institute and China Coal Transportation and Marketing Association. Retrieved February 15, 2011 from http://www.indaa.com.cn/zz/nypl/nypl0908/200908/t20090807_198631.html.
185 Zhao, Le et al. (September 10, 2009). China energy price reform and prediction (in Chinese). China Economic Times et al. Retrieved February 15, 2011 from www.china.com.cn/news/zhuanti/09ny/2009-09/10/content_18502046.htm.