

China's rising climate risk

The 20 questions investors need to ask

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- ▶ **China's water, food and energy resources are under great stress; the impact on each province is different**
- ▶ **This has serious implications for companies that source from, operate in and sell to China**
- ▶ **We list the 20 crucial questions investors need to ask to assess corporate risks, strategy and operations**

China's government believes climate change is increasing the pressure on the country's already stressed water, food and energy resources. Water supplies are stretched, food prices are rising and energy shortages are adding to costs.

All three problems are having a different impact on provinces, depending on the nature of their economies. This increases business risk for companies sourcing from, operating in and selling to China. For example:

- ▶ 14 provincial economies could be at risk from water stress because they are heavily reliant on manufacturing.
- ▶ Henan, Shandong and Hebei account for half of China's wheat production; these provinces collectively suffer from extreme water scarcity.
- ▶ Energy intensity is the key to cutting the energy deficit; provincial targets are now in place for 2015.

We believe the challenges are so severe that to meet tough new environmental targets some provinces – including powerhouse Guangdong – may have to change the make-up of their economies. This raises important questions about where companies set up operations or source materials from.

This report looks at these problems in the context of what China is doing to improve resource efficiency in terms of water, food and power supplies, and create a low carbon economy. We provide a checklist of 20 key questions we think investors and businesses need to ask to assess risks levels, corporate strategy and operational efficiency.

China is responding to the challenge of climate change. We believe it is time investors followed suit.

Contents

| | |
|---------------------------------|-----------|
| Summary | 3 |
| The 20 key questions | 5 |
| The resource challenge | 6 |
| Rising resource stress | 6 |
| The climate multiplier | 8 |
| Provinces and policies | 9 |
| Resource efficiency in policies | 9 |
| Portfolios | 13 |
| Priority themes | 14 |
| Water | 14 |
| Food and agriculture | 18 |
| Energy intensity | 22 |
| Financing the transition | 24 |
| Conclusion | 25 |
| Disclosure appendix | 26 |
| Disclaimer | 27 |

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Summary

- ▶ The impact of climate change is deepening China's efficiency drive in water, carbon and energy
- ▶ The levels of water stress and energy intensity vary greatly between provinces
- ▶ Climate risks affect investors in companies which source from operate in, and sell to China

China is vulnerable

In HSBC's report *Scoring Climate Change Risk*, 9 August 2011, we assessed the vulnerability of the G-20 countries in terms of their exposure, sensitivity and adaptive capacity. China was found to be the third most vulnerable country after India and Indonesia.

There is little doubt that resource stress is a growing problem in China – 2011 has seen the continuation of problems such as droughts and floods, stressed agricultural yields and unstable energy supply.

The Chinese government believes climate change, expressed through water availability (too much and too little) and increased temperatures, is exacerbating these *existing* problems, putting further pressure on already stretched infrastructure and compounding the problem of rising food prices, water scarcity and power shortages.

The problems vary

The severity of the impact on each province depends on the make-up of their economies in terms of primary industry (natural resources),

secondary industry (manufacturing) and tertiary industry (services). For example:

- ▶ Nine provinces suffer from extreme water scarcity.
- ▶ Only six provinces have both above average GDP growth and above average water availability per capita. Other fast-growing provinces could be at risk if water availability falls.
- ▶ 11 provinces are very water inefficient and they are clustered in the north and southwest of the country – areas where China would like to develop.

We have identified 14 provinces we consider to be high risk because their economies are also dependent on secondary industry; this risk could be greater for those sectors which rely heavily on water and energy (Figure 3, page 16).

China's triple efficiency drive

In our view, China's government is taking action to address these problems. Policies are based on the premise that low-carbon growth and more efficient use of its natural resources are essential for the development of the country. The 12th Five-

Year Plan (FYP) for 2011-15 released earlier this year includes a triple efficiency drive relating to water, energy and carbon intensity.

Table 1: Key targets in China's 12th Five-Year Plan

| | Details of targets and dates to be achieved |
|-------------------------|---|
| Water intensity | Water consumption per unit of value-added industrial output to be cut by 30% |
| Energy intensity | Energy consumption per unit of GDP to be cut by 16% |
| Carbon intensity | Carbon dioxide emission per unit of GDP to be cut by 17% |
| New energy | Non-fossil fuel to account for 11.4% of primary energy consumption |
| Forest coverage | Forest coverage rate to rise to 21.66% and forest stock to increase by 600 million cubic metres |

Source: Key targets of 12FYP, Chinese Government

The promotion of seven strategic emerging industries (Table 6, page 12) is also a clear sign of government investment priorities. There is also a strong focus on water conservation, water efficiency and the importance of irrigation, as outlined in an important government strategy document (known as No.1 Document, Table 5, page 11). A climate change law is being drafted and other policies will emerge during the next few years to deal with resource conservation and help transform China into a low-carbon economy.

Portfolio implications

In our view investors should begin to look at climate change as a key business risk – scrutinising portfolios to assess the concentration of risks to certain provinces and policies.

The climate factor affects industries closely related to resource stress through raw material costs, inflation and demand degradation. Exposed businesses need to plan for resource constraints and incoming efficiency policies.

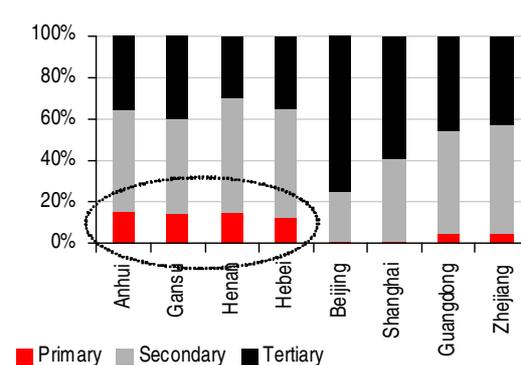
Priority themes

Water

The availability of water is important to many industries and certain provinces could be at risk if local authorities do not increase investment in water conservation and water infrastructure.

Water is vital to primary industry and any further stress poses a risk to Anhui, Gansu, Henan and Hebei provinces (Chart 1).

Chart 1: Industry contribution to GRP, 2009



Note: The absolute monetary value of primary industry is lower than that of secondary and tertiary because of the economic value of the products
Source: Adapted from the National Bureau of Statistics of China

Food and agriculture

Henan, Shandong and Hebei account for half of China's wheat production yet their collective water availability is well below scarcity and stress levels¹ (Chart 12, page 18). Improved irrigation is a priority because water productivity tends to increase with irrigation. Increasing forest coverage also protects soil and boosts water holding capacity.

Energy intensity

Water is also a key input into the energy sector and its scarcity magnifies existing power shortages as hydro production slows. Energy intensity reduction targets are an important tool the government can use to bring the energy deficit under control. For example, Guangdong's 12FYP target is higher than that achieved during the 11FYP. To meet this target it needs to improve efficiency and also shift its economy towards the service sector.

¹ Water stress is defined as a region having water availability in the range of 1,000 to 1,700 m³/person/year, and water scarcity less than 1,000 m³/person/year.

The 20 key questions

The implications of climate change are wide and varied. We provide a checklist of 20 key questions investors with China exposure in their portfolios should ask as part of due diligence. This list can be applied to Chinese companies as well non-Chinese companies, such as a FTSE 100 company.

“China exposure” refers to upstream supply chains, the location of production facilities and logistics. It includes any companies sourcing from China, companies with facilities operating in China and companies selling into China. “Companies” within this checklist refers to companies, business divisions or any facilities within supply chains.

Business exposure

Water

- 1 Which companies are directly exposed to serious water availability constraints? (Figure 4, page 17)
- 2 Which companies are located in provinces and areas prone to droughts/floods? (Figure 1, page 8)
- 3 Which companies have been materially affected by water stress (e.g. production disruption)?
- 4 Which companies are materially affected by rising water prices?

Energy

- 1 Which companies are located in provinces with ambitious energy intensity reduction targets? (Figure 8, page 24)
- 2 In energy intensive sectors, what is the energy performance of companies compared with sector benchmarks?
- 3 Which companies have been materially affected by disruptions to energy supply?
- 4 Which companies are materially affected by rising energy costs?

Corporate strategy

- 1 Are the risks of resource stress in China understood at board level?
- 2 Does corporate strategy incorporate future resource stresses?
- 3 Are provincial resource differences considered (e.g. resource availability, efficiency targets)?
- 4 Is the company investing into R&D to make operations and products more efficient? (Table 6, page 12)
- 5 Are resource stress factors incorporated into business location decision making?
- 6 Does management exhibit a good understanding of key policy and regulatory trends? (Table 4, page 11; Table 5, page 11)

Operational effectiveness

- 1 Does the company have accounting systems to monitor its use of resources, and that of its supply chains?
- 2 Does the company set internal targets which are adhered to and disclosed?
- 3 What contingencies have been put into place to respond to resource disruption?
- 4 What steps is the company taking to optimise its finances, including insurance, to manage resource stress?
- 5 What evidence is there of good relationships with local communities and regulators on resource management?
- 6 How is a company managing resource risk through diversification of sourcing and logistics?

The resource challenge

- ▶ China is already exposed to stresses in water, food and energy
- ▶ The climate factor makes resource stress problems more acute
- ▶ Inflation and infrastructure are priority areas for the government

Rising resource stress

China needs to make more efficient use of its resources. Its vast population, the shift towards urban lifestyles and the transformation into the manufacturing hub of the world have all exacted a heavy toll on its natural capital.

The government has recognised the problem. One of the main objectives of the 12FYP is to **“effectively conserve resources and protect the environment. We will actively respond to climate change.”**² Details of how this will be achieved are slowly emerging in the policies released at sector and province level. These, in turn, will filter down to the prefecture and county level.

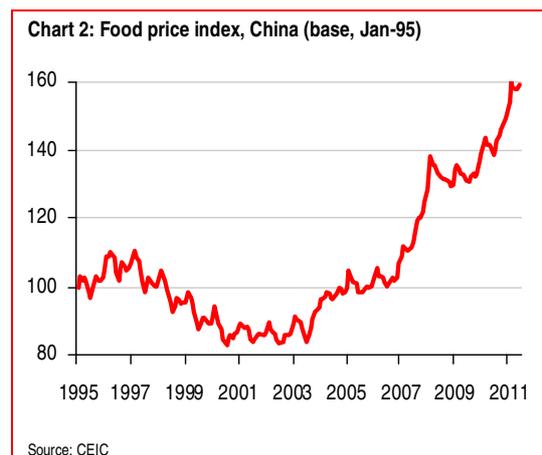
Resource stress is on the rise

Water, food and energy are closely related; a change in one can affect the others.

Food inflation concerns

The importance of inflation is underscored by China’s underlying drive to maintain social stability. Full stomachs and clean water to drink are clearly top priorities for officials. Although increases in food prices cannot be wholly attributable to resource stress, we believe that the combination of climate (e.g. droughts), higher

temperatures and demand have contributed to the rapid rise in food prices (Chart 2).



The government has been fighting inflation, particularly food inflation which has been especially difficult to control in 2007 and 2011.

Energy supply-demand imbalance

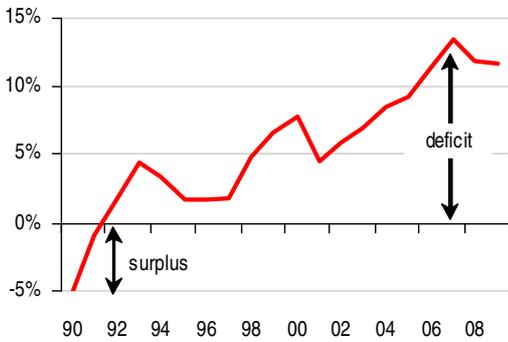
The production of energy in China has not kept up with demand, leading to well-documented blackouts at certain times of the year.

The energy deficit has become more acute in recent years mainly because the infrastructure to provide power has not kept up with the build out of manufacturing and industry (Chart 3). The hot summer months add to energy demand as the growing urban population seeks refuge in air conditioning.

² Main objectives and tasks for the 12th Five-Year Plan, Premier Wen Jiabao, NPC meeting, 5 March 2011

The need to meet “energy efficiency” targets has also been a problem. In December 2010 local officials enforced power blackouts in order to meet the 20% energy efficiency reduction targets by year-end 2010.³ The central authorities recognise that this hampers productivity and affects the competitive position of companies. Producing more energy more efficiently is a policy priority.

Chart 3: China's energy imbalance

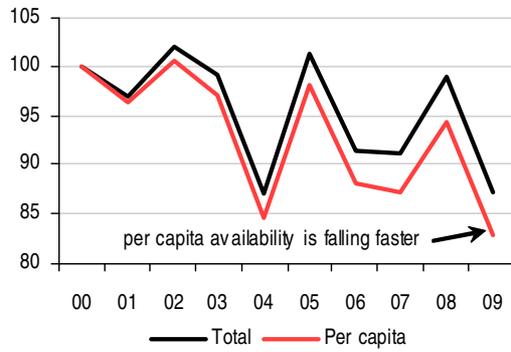


Source: Adapted from the National Bureau of Statistics of China

Water scarcity issues

China's water resources have fallen in the last decade. Although annual variations can be expected the use of water by agriculture, industry and the general population has increased. In 2009 agriculture was the top consumer of water, taking 62% of all water consumed. Chart 4 shows that the water available per capita has fallen more quickly than the total water resources available, further highlighting the strain on the country's natural resources.

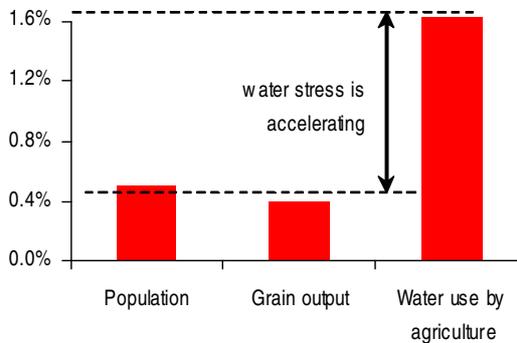
Chart 4: Water resources index (base 2000)



Source: National Bureau of Statistics of China

Grain output is a function of water and temperatures – two factors closely related to climate change. However, in 2009 the use of water by agriculture increased but did not result in a similar growth in grain output (Chart 5).

Chart 5: y-o-y increase in population, grain and water use (2009)

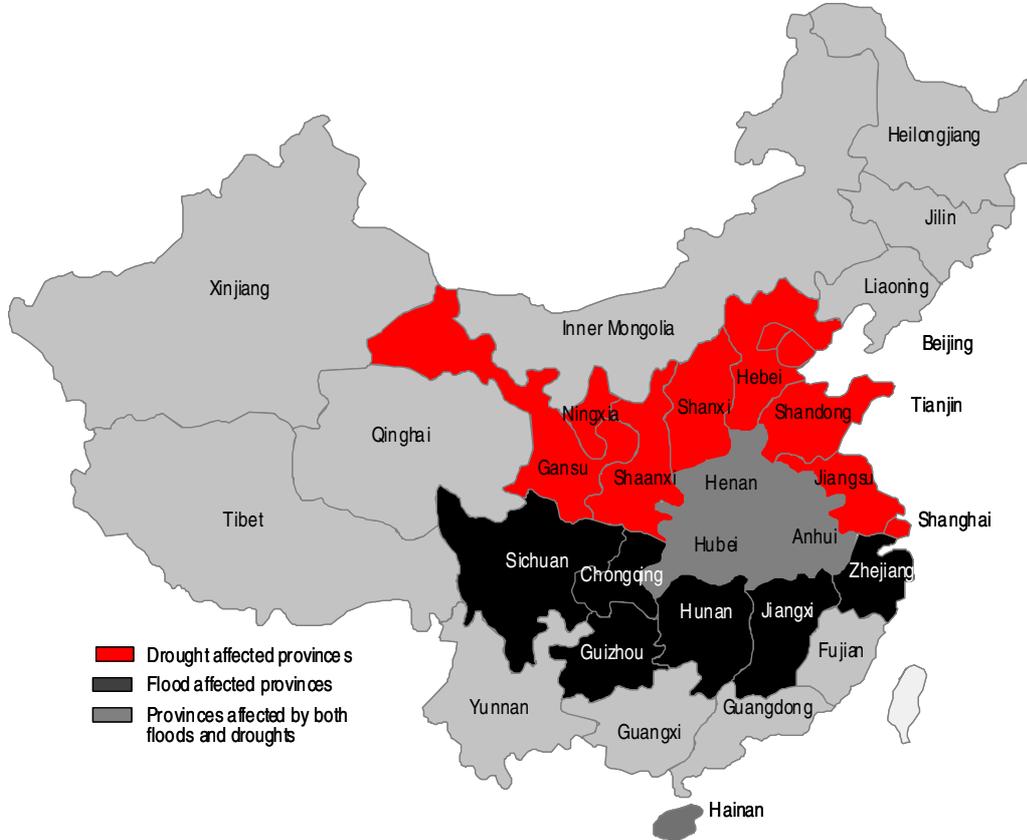


Source: National Bureau of Statistics of China

The winter drought earlier this year crippled wheat producing provinces in northern China. The central authorities mobilised internal resources to help – the first response was to dig around 11,000 wells. Although this solved the immediate water shortage, over the long term it exacerbates the depletion of the water table.

³ “China improves energy efficiency 20 percent in 5 years, hits target with blackouts, power cuts”, Associated Press, 6 January 2011

Figure 1: China – Extreme water events January to June 2011



Source: HSBC (based on data from FAO and International Federation of Red Cross and Red Crescent Societies)

The climate multiplier

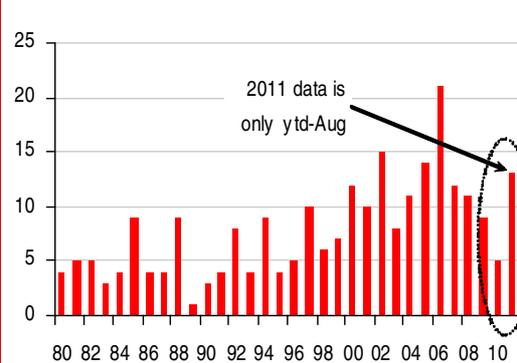
In our view, climate change will only serve to make these resource stresses more acute and over the long term may also increase the frequency and magnitude of floods.

Extreme weather in 2010 caused 4,800 deaths and resulted in direct economic losses of RMB500bn (USD75bn) in China. The National Climate Center believes that “global warming was largely to blame for the country’s frequent extreme weather.”⁴ 2011 has seen more extreme events than 2010 (Chart 6) and the map in Figure 1 shows the areas affected by extreme water events in the first half of 2011.

Besides actively responding to climate change, the government is working on policies to maximise

the value derived from natural capital and utilise these resources in a more efficient manner.

Chart 6: Number of extreme events in China since 1980



Source: EMDAT

The government clearly realises the importance of natural capital to the economy.

⁴ “Extreme weather hit China hard,” *China Daily*, 13 January 2011

Provinces and policies

- ▶ Provinces vary greatly in terms of economic activity, water resources, water productivity and energy intensity
- ▶ This means location matters for industries, individual companies and investors
- ▶ Resource efficiency and climate change are key policy drivers

In this section we examine how some of the potential effects of resource stress and its reaction to climate change may affect provinces. In our view the government is responding by pushing through policies to improve resource efficiency.

We believe climate change could cause increasing problems to the availability of natural resources, and subsequently affect where growth takes place in China. The map overleaf (Figure 2) breaks the nation into its 31 provinces, autonomous regions and municipalities (we refer to them collectively as provinces) and their contribution to national GDP. It should be noted that the GDP of a province is called Gross Regional Product (GRP). The top 10 are shown in Table 2.

Table 2: Top 10 provinces in terms of GRP in China, 2009

| Rank | Province | Contribution to national GDP (%) |
|------|-----------|----------------------------------|
| 1 | Guangdong | 10.8 |
| 2 | Jiangsu | 9.4 |
| 3 | Shandong | 9.3 |
| 4 | Zhejiang | 6.3 |
| 5 | Henan | 5.3 |
| 6 | Hebei | 4.7 |
| 7 | Liaoning | 4.2 |
| 8 | Shanghai | 4.1 |
| 9 | Sichuan | 3.9 |
| 10 | Hunan | 3.6 |
| 13 | Beijing | 3.3 |

Source: National Bureau of Statistics in China

China's economy is broadly classified into three strata of industry, the definitions used by China's National Bureau of Statistics can be seen in Table 3.

Table 3: Classification of economic activities in China

| Strata (broad definition) | Sectors involved |
|--|---|
| Primary industry (Natural resources) | Agriculture, forestry, animal husbandry, fisheries; services in support of these industries |
| Secondary industry (Industry & construction) | Manufacturing, construction, mining and quarrying; production & supply of electricity, water, gas |
| Tertiary industry (All others not in primary or secondary) | Transport, storage & post, wholesale & retail trades, hotels & catering services, financial intermediation, real estate, others |

Source: HSBC and the National Bureau of Statistics in China

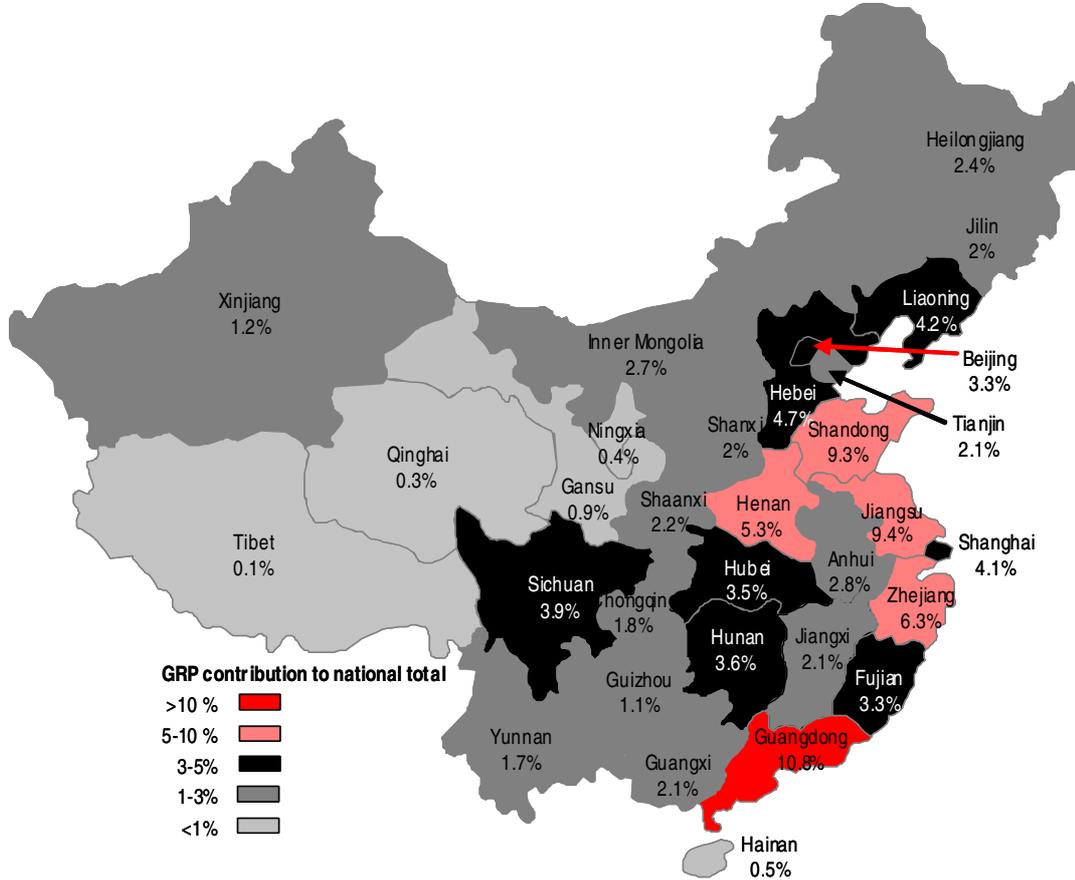
Resource efficiency in policies

We believe policy in China will be premised on improving the efficient use of natural resources, indicating the government's determination to move away from an inefficient, high-carbon economy.

In recent years a number of policies have been released relating to irrigation, water conservation, afforestation, energy efficiency, renewable energy, and carbon intensity. More will filter through in the near future following the release of the 12th Five-Year Plan (12FYP) in March 2011.

We believe the "climate signal" is already apparent in central government policies.

Figure 2: Provincial contribution to China's national GDP, 2009



Source: HSBC (based on data from the China Statistical Yearbook, 2010)

It should be noted that policies and targets in China are first set at a national level; there are then negotiations between central and provincial-level authorities to set provincial targets. The process is repeated until county, town and village-level targets are set. More details on this hierarchy can be found in the “How the system works” chapter in the report *Inside the growth engine* (December 2010) by Zhang Zhiming, HSBC’s Head of China Research.

We highlight four major policies:

- ▶ The 12th Five-Year Plan
- ▶ The No.1 Document (on water)
- ▶ Seven strategic emerging industries
- ▶ Special law on climate change

12th Five-Year Plan

The 12FYP sets out broad nationwide targets to move China towards a low-carbon economy and on a path of sustainable development. Professor Hu Angang of the Chinese Academy of Sciences and Tsinghua University calculated that a third of the targets in the 12FYP were related to resources and the environment.⁵

The political rhetoric since the release of the plan in March was repeated by Premier Wen Jiabao as recently as the World Economic Forum in Dalian in September when he said: “We will ... develop low-carbon industrial, construction and transportation systems, promote energy, water,

⁵ “China’s green era begins”, *China Dialogue*, 8 March 2011 (note, population targets are excluded).

land and material conservation and integrated resource utilisation, preserve and repair the ecosystem, increase forest carbon sink, and build stronger capacity for tackling climate change.”⁶

Targets relating to low-carbon and resource conservation can be seen in Table 4.

Table 4: Key targets in China’s 12th Five-Year Plan

| Details | |
|-------------------------|---|
| Water intensity | Water consumption per unit of value-added industrial output to be cut by 30% |
| Energy intensity | Energy consumption per unit of GDP to be cut by 16% |
| Carbon intensity | Carbon dioxide emission per unit of GDP to be cut by 17% |
| New energy | Non-fossil fuel to account for 11.4% of primary energy consumption |
| Forest coverage | Forest coverage rate to rise to 21.66% and forest stock to increase by 600 million cubic metres |

Source: [Key targets of 12FYP](#), Chinese Government

The 12FYP also intends to rebalance the economy so that services contribute more to national GDP. The rationale is to reduce “investment-driven excesses”, lower pollution and consume less resources; this should also help with carbon intensity as services tend to emit less carbon dioxide per unit of GDP than manufacturing and heavy industry.

No.1 Document – water

China issues a No.1 Document each year which usually focuses on a single key issue of top priority for government agencies to work on. For the past eight years, the focus was agriculture. In 2011 water was the focus of this major policy directive for the first time, especially conservation and irrigation because “floods and drought in recent years have exposed weaknesses in water conservancy infrastructures.”⁷

RMB4trn is scheduled to be spent during 12FYP and 13FYP to improve water infrastructure. Some 10% of revenue from land sales will be set aside for water conservation projects in rural areas, although details of how this will be implemented locally are yet to be released.

Table 5: Key points in China’s No.1 Document on water, 2011

| Details of targets and dates to be achieved | |
|---|---|
| Investment | Total investment of RMB4 trillion (cUSD600bn) into water projects through to 2020, or about RMB400bn per year |
| Consumption | An annual consumption cap on water of 670 billion cubic metres is expected to be achieved by 2020 (<i>Note: in 2009, consumption was 596.5 billion m³</i>) |
| Efficiency | The efficiency rate for rural irrigation should be improved to at least 55% by 2015 (current c48%) |
| Irrigation | Increase the area of irrigated land by 2.7 million hectares by 2015 |
| Construction | Build effective flood control and drought relief systems by 2020 |

Source: Chinese Government website, [press release](#), 30 January 2011

In response to the No.1 Document, the State Council and Ministry for Water Resources have begun releasing details about how targets will be met (see page 17 for details).

Seven strategic emerging industries

As part of the efforts to lower carbon intensity and improve resource efficiency, the government has also identified seven strategic emerging industries it aims to promote (Table 6). The sectors and technologies promote better use of resources. For example, smart meters would improve energy efficiency; bio-agriculture would improve land use; and electric vehicles would conserve oil.

⁶ Premier Wen Jiabao, speech at Annual Meeting of the New Champions 2011, *People’s Daily*, 15 September 2011

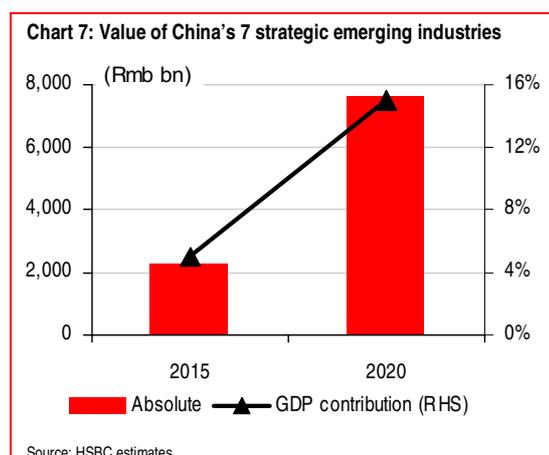
⁷ “China to invest \$608b in water projects,” *China Daily*, 31 January 2011

Table 6: China's seven strategic emerging industries

| Strategic Emerging Industry | Example of related sectors |
|--|--|
| Energy-saving and environmental protection | Energy efficiency, environmental protection, energy services, recycling, |
| Next generation IT | Smart meters, cloud computing, next-generation communications |
| Bio-technology | Bio-medicine, agriculture, manufacturing |
| High-end manufacturing | High-speed rail, aeronautics, astronautics, marine engineering |
| New energy | Renewable energy |
| New materials | LED lighting; special function, composite materials |
| Clean energy vehicles | Electric vehicles (EV), hybrids, fuel cell, advanced batteries |

Source: China's State Council, The Climate Group, HSBC

HSBC's chief economist for greater China, Qu Hongbin, forecasts these industries will share 5% of China's GDP by the end of the 12FYP and 15% by the end of the 12FYP period (Chart 7).



We believe further policy measures will provide incentives to promote these industries and, in turn, resource conservation.

Climate change law

In August 2009 the Standing Committee of the National People's Congress (NPC) met to discuss China's response to climate change. The six main resolutions adopted can be seen in the table that follows.

Table 7: Resolutions adopted by NPC on climate change, 2009

| | Resolution summary |
|--------------------|---|
| Importance | Addressing climate change is an opportunity & challenge for economic & social development |
| Science | Response to climate change must be based on the implementation of the Scientific Outlook on Development |
| Measures | Concrete measures must be taken to actively respond to climate change |
| Legislation | The legal framework for addressing climate change must be strengthened |
| Capacity | Raise the awareness & capability of the general public to cope with climate change |
| Cooperation | China will actively participate in international co-operation to tackle climate change |

Source: NPC, Resolution of Standing Committee, 10th meeting of 11th NPC, 27/08/09

Following on from these resolutions, the Government is undergoing a series of consultations with regards to drafting a special law on climate change. Many different layers of government and academic institutions are involved. The National Development and Reform Commission (NDRC), through the Department of Climate Change, has been tasked with drafting the new legislation⁸.

We expect to see more details from next year, possibly in conjunction with a provincial breakdown of carbon intensity reduction targets.

Future policies

Further to the four key policies mentioned above, we expect more granularity relating to the 12FYP for provinces, prefecture and county levels to be released soon. We also expect more details on the implementation of carbon intensity reductions by industry and pilot carbon trading schemes. The NDRC also aims to publish plans for the sustainable development of the nation's "resource-based cities" in the coming months.

It may be difficult to implement these policies. For example, a shift away from primary industry must also involve providing for the communities affected and engaging in serious water

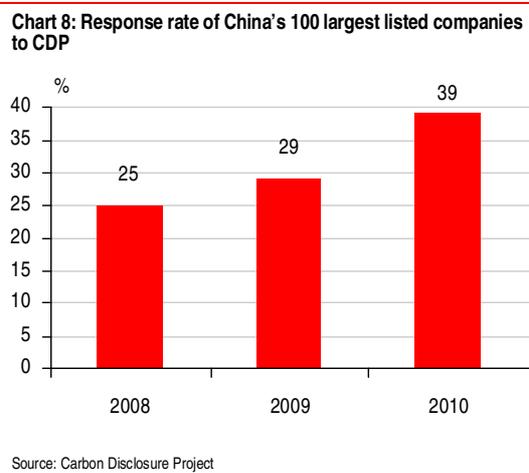
⁸ [China Climate Change Info](#) (English); [NDRC seeks public comment on climate change legislation](#) (Chinese)

conservation policies is a challenge when water is not an easy commodity to transport or manipulate. We believe one of the biggest challenges facing the country is the filtering down of implementation to the local level.

Portfolios

Resource stress and exacerbation by climate change will affect many industries. For example, the costs of raw materials may increase as they become more difficult to secure; wages may increase as workers suffer from inflation; demand may decrease as spending is limited to essentials.

There is increasing evidence that companies in China are beginning to understand the risks associated with resource scarcity and are taking these issues into account in their corporate strategies. The response rate of Chinese companies to the annual Carbon Disclosure Project Survey⁹ has been increasing in recent years (Chart 8) indicating a willingness to acknowledge and respond to the issues of resource scarcity and climate change.



In our view investors should begin to look at climate change as a key business risk and incorporate this risk into investment analysis and valuation. There are also opportunities associated with climate change which should not be overlooked as shown by the potential growth of the seven strategic emerging industries. Investors also need to scrutinise portfolios to see whether there is a concentration of risk in certain provinces or industries.

⁹ Carbon Disclosure Project (CDP)

Priority themes

- ▶ Water quality and quantity are key for an economy to function
- ▶ Food and agriculture need clear forestry and irrigation policies
- ▶ Energy intensity reduction can change the economic composition of provinces

In this section we look at the importance of water, food and agriculture, and energy intensity to different provinces based on the composition of their economy.

Water

Water is the primary vector of climate change and is apparent through changing patterns of availability – droughts and floods.

Water quality

The availability of water is also affected by its quality. Not only does drinking water need to be of a particular standard, but the water used in certain industries must also meet standards. According to the Ministry of Environmental Protection (MEP), over a quarter of China's water is only fit for industrial or farm irrigation purposes. It does not meet the standards for fish farming and municipal use. This compounds the problem of water scarcity.

The 12FYP intends to “accelerate the treatment of water pollution in key river basins”¹⁰. In September the State Council released preliminary

details¹¹ of how emissions of chemical oxygen demand (COD), a key measure of water pollution, would be reduced at a provincial level.

Water conservancy required for GDP growth

GDP requires water supplies to be maintained in order to continue high growth rates. The need for water conservancy at a provincial level can be seen in Chart 10 overleaf. There are only six provinces in the top right of the chart, representing those that have above average GDP growth as well as above average water availability. Those in the top left quadrant are growing their economies quickly but perhaps not investing enough in water infrastructure.

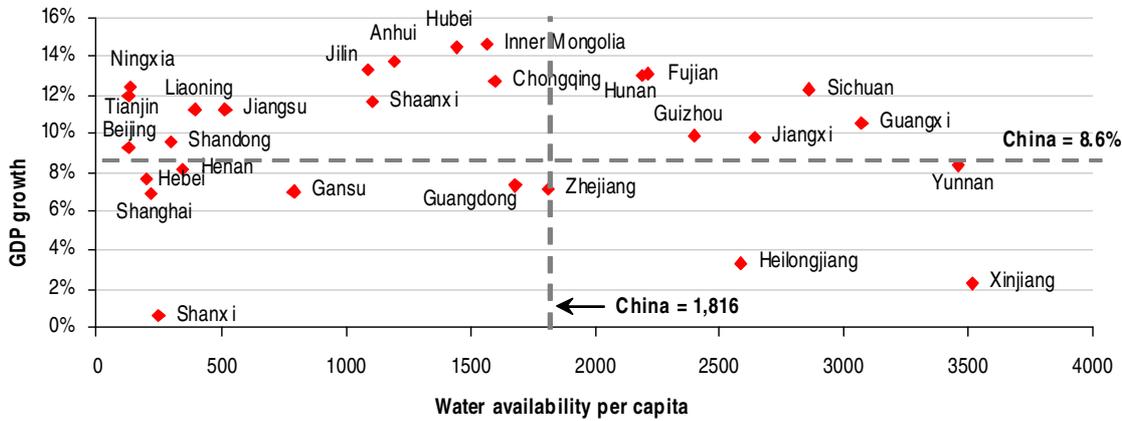
We believe the growth of these provinces and the companies that operate in them could be at risk from potential water stress if local authorities do not invest more in water conservation and facilities for withstanding droughts and floods.

In August the Ministry of Finance (MOF) made an initial allocation of RMB11.6bn from the central government's budget to support water conservancy and irrigation projects across the country. We expect more funds to follow.

¹⁰ *Main objectives and tasks for the 12th Five-Year Plan*, Premier Wen Jiabao, NPC meeting, 5 March 2011

¹¹ *Energy Conservation and Emissions Reduction Comprehensive Work Plan for the 12th Five-Year Plan*, Annex 2

Chart 10: GDP growth vs. water availability per capita (m³/person/year) in Chinese provinces, 2009



Source: HSBC (adapted from the China Statistical Yearbook, 2010)

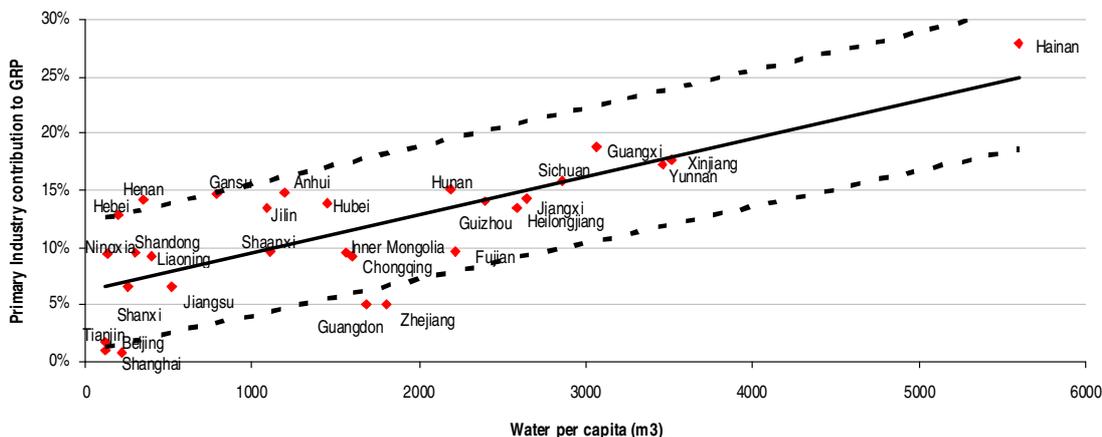
Water is vital to primary industry

The scatter diagram (Chart 9) overleaf shows the contribution of primary industry (agriculture, forestry, livestock & fisheries) to GRP against water per capita in each province. The central trend line shows the average for the country and follows an expected linear pattern – the more water a province has, the more primary industry contributes to the economy. As provinces move further under the average trend line, primary industry becomes less important as the economy moves into other industries such as manufacturing and production, and the mining of non-renewable resources such as minerals and metals.

The provinces/cities closest to the lower standard deviation line, Beijing, Shanghai, Guangdong and Zhejiang, are the most developed. Their economies are mostly based on, or increasingly moving towards, tertiary industry such as services (Chart 11). In our view, any episodes of extreme resource stress are less likely to affect these provinces because of their relatively advanced economies.

In contrast, the economies of provinces towards the upper standard deviation line, Anhui, Gansu, Henan and Hebei, depend much more on natural resources, as evidenced by the relatively higher contribution of primary industry to their GRP. These economies would suffer most if natural

Chart 9: Relationship between primary industry contribution to GRP and water availability per capita in Chinese provinces, 2009



Source: HSBC (Adapted from China Statistical Yearbook, 2010)

Note: Primary industry refers to agriculture and forestry, livestock and fisheries

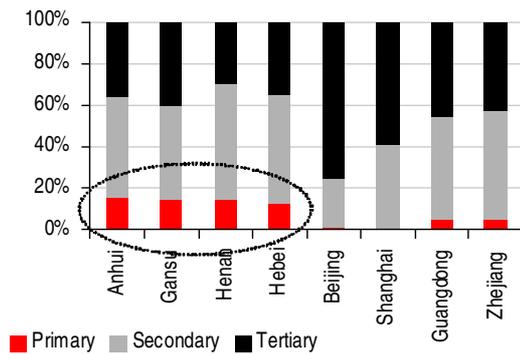
resources suffered stress through non-replenishment, an extreme event such as a drought, or a shift in water allocation through the effects of climate change.

Water stress is a potential risk

We have identified 16 provinces/cities which suffer from less than adequate water resources per capita. With the exception of Beijing and Shanghai, where the contribution of tertiary industry (i.e. services) is enough to sustain the economy, all other 14 provinces could be at risk should resources experience further deficiency.

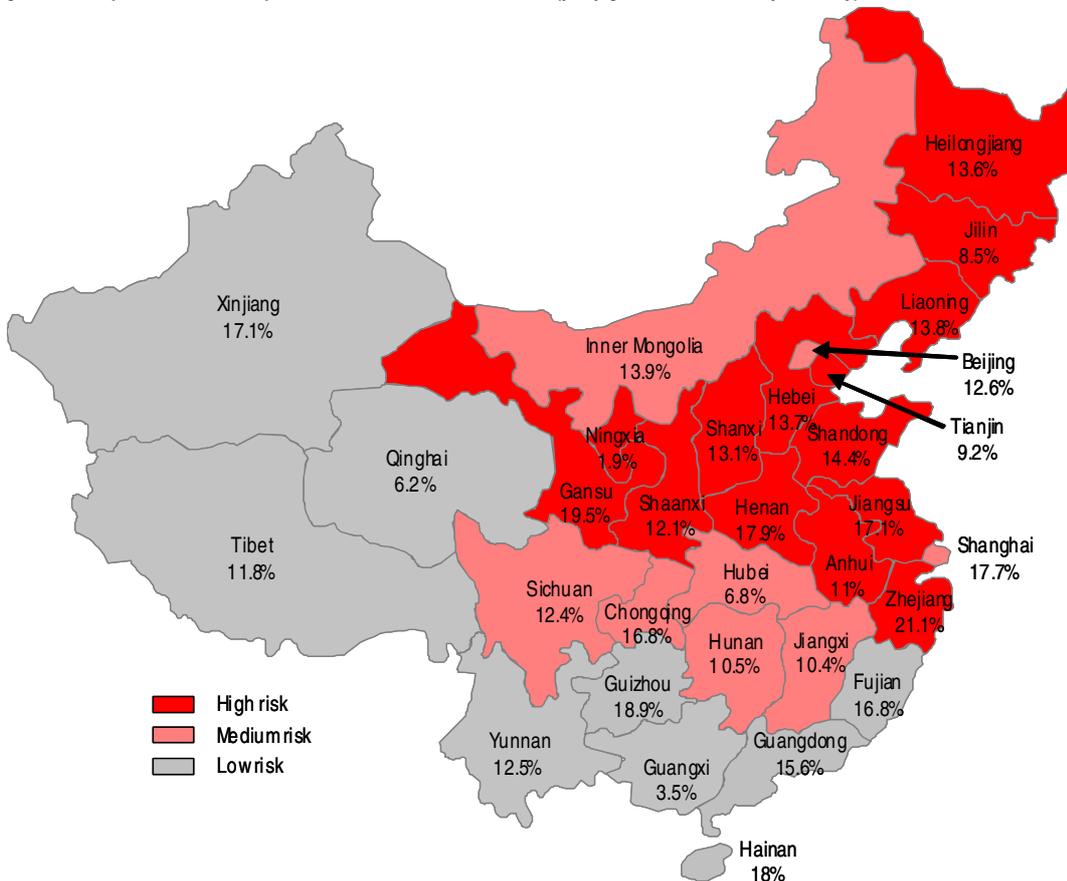
The map below highlights this issue as these 14 provinces are not only water stressed, but also have secondary industry as the major contributor to GRP. We assess the relative risk based on the availability of water resources, the current contribution of secondary industry to GRP and the growth of this secondary industry.

Chart 11: Industry contribution to GRP, 2009



Note: The absolute monetary value of primary industry is lower than that of secondary and tertiary because of the economic value of the products
Source: Adapted from the National Bureau of Statistics of China

Figure 3: Risk profile of Chinese provinces in terms of water stress (y-o-y growth in secondary industry), 2009



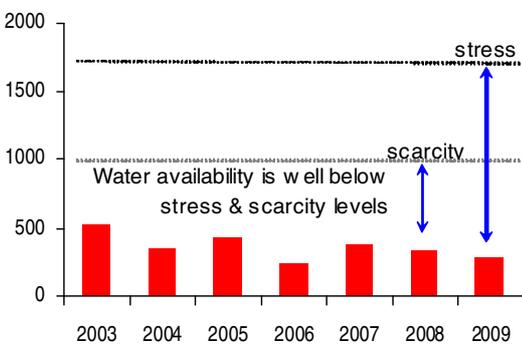
Food and agriculture

Agricultural yields and stable food prices are highly important for the government as China seeks food self-sufficiency. In addition, primary industry in general employed 38% of the workforce in 2009. Combining these with social stability makes for strong underlying policy towards agriculture and resource conservation in forestry and water.

The map on the previous page (Figure 4) depicts the water availability levels in China by province. The cluster of red also highlights the provinces most affected by the winter droughts of 2010 and 2011; these provinces account for two-thirds of wheat production in China.

The key provinces of Henan, Shandong and Hebei collectively account for over half of China's wheat production. Water availability per person in these provinces is actually well below stress and even scarcity levels (Chart 12), indicating the severity of water problems in these wheat growing provinces. Furthermore, availability levels have been on a downward trend in recent years; any further declines could seriously affect the production of wheat.

Chart 12: Water availability per capita (m³/person/yr) in Henan, Shandong, Hebei



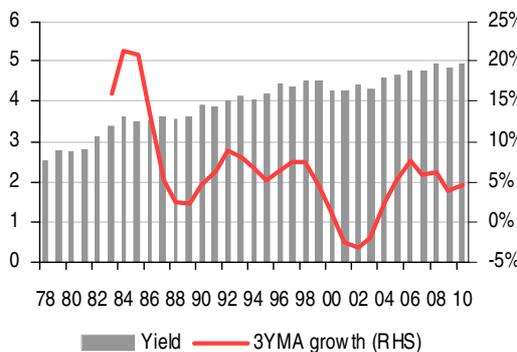
Source: HSBC (Adapted from National Bureau of Statistics of China)

Extreme weather events affect yields

Zheng Guoguang, head of the China Meteorological Administration, estimates that “in recent years, extreme weather such as floods, droughts, rainstorms, and low temperatures had caused average grain losses of 50 billion kg a year in China, with drought causing the greatest harm.” To put that in context, this is equivalent to 50 million tonnes of grain (rice, wheat and corn) or approximately 10% of China's annual grain output.

The area of land used for agriculture has been declining in recent years and although crop yields in China have made significant gains since 1978, they cannot continue to grow forever. Chart 13 shows the yield improvement in China – with signs that the rate of growth is slowing down. Furthermore, it has been suggested in a recently published paper¹² that rises in temperature have lowered crop yields globally.

Chart 13: China grain yields (ton/ha) and 3-yr moving average growth



Source: HSBC (based on data from CEIC)

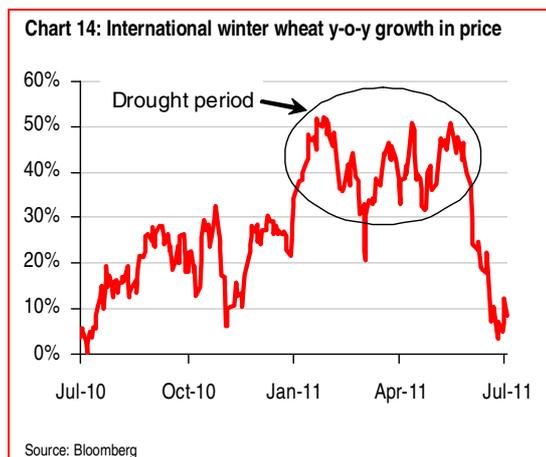
Winter drought in 2010-11

China experienced a severe drought this winter. The drought mainly affected eight provinces which encompass 80% of winter wheat growing regions. Food prices in China rose 9.6% in December and 10.3% in January. Volatility in

¹² “Climate Trends and Global Crop Production since 1980”, Lobell et al., *Science*, DOI: 10.1126/science.1204531

food prices was further affected as farmers refused to sell wheat because they expected prices to rise in subsequent weeks; flour mills had to shut down as a result¹³.

The drought in China also had an effect on international wheat prices as there were fears that China would have to import wheat to meet the shortfall in supply. Whilst domestic wheat prices rose around 10% y-o-y (as captured on a monthly basis), international winter wheat prices spiked up to 50% y-o-y (as captured on a weekly basis) during the height of the drought (Chart 14)



Agricultural policies

One of the goals of the 12FYP is “safeguarding food security” as well increasing agricultural production capacity to at least 540m tonnes (actual grain production in 2009 was 531m tonnes).

China will spend more on agriculture and is looking to strengthen policies which will benefit the industry, although details have not yet been released. Expected policies as mentioned in the 12FYP include subsidies for crop production, more favourable credit and loan policies towards agriculture and the development of an agricultural reinsurance system.¹⁴

¹³ “Rallying cry to farmers in war on drought”, *SCMP*, 16 February 2011

¹⁴ *Main objectives and tasks for the 12th Five-Year Plan*, Premier Wen Jiabao, NPC meeting, 5 March 2011

Irrigation is crucial

China’s first formal irrigation policies were introduced in 1988 to deal with the largest sector user of water – agriculture. Of the 120m hectares of arable land in China, less than half have irrigation systems. Without irrigation systems, croplands are highly dependent on natural precipitation and hence more susceptible to droughts. This year’s winter drought was compounded by the lack of irrigation in certain winter wheat growing areas.

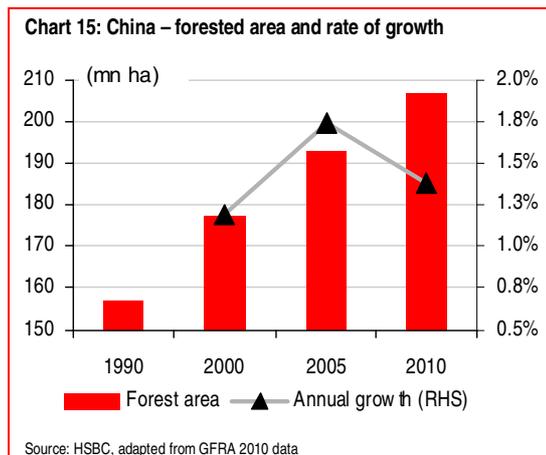
Although investment in irrigation systems in previous five year plans has reduced the sector’s overall consumption portion of water from 69% in 2000 to 62% in 2009, more still needs to be done; irrigation was a key policy in both the 12FYP and the No.1 Document. China will “significantly improve agricultural irrigation, the efficiency of water resources use and resistance to flooding.”¹⁵

We believe another reason why the government is so keen to increase the area of irrigation is that, in general, the water productivity of a province increases as its irrigated area increases. That is, a province can produce more economic value with less water (productivity) if the water it has is put to better use (irrigation). This can be seen in the map in Figure 5 overleaf.

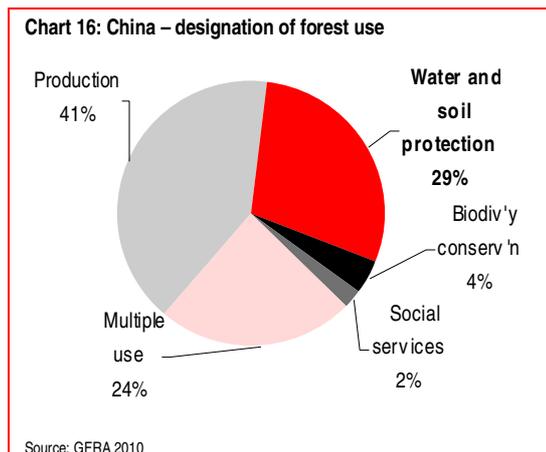
In our view companies which have major operational exposure to key grain-growing provinces could be at risk from further resource stresses. Industries which source raw materials from these provinces might also be affected – for example, food processing, feedstock for animals, food retailers, as well as derivative sectors such as fibre and textiles, and potentially oleochemicals.

¹⁵ *Main objectives and tasks for the 12th Five-Year Plan*, Premier Wen Jiabao, NPC meeting, 5 March 2011

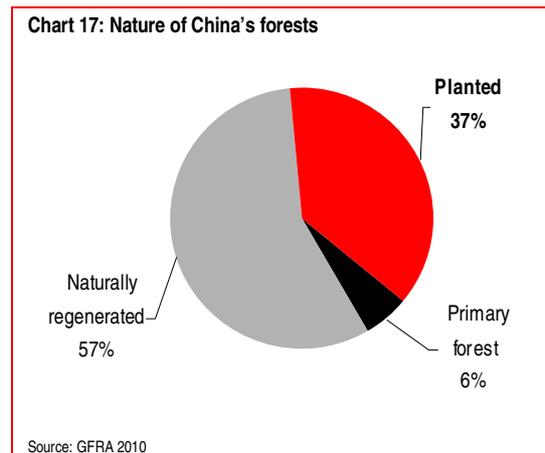
During the 1990s the forested area increased by approximately 2m hectares each year (1.2%) and this accelerated to 3m hectares (1.6%) over decade 2000-10, which makes China the top country globally in terms of annual net gains in forested area¹⁶.



Approximately 22% of China’s land mass, or 207m hectares, is forested. Of this, over 60m hectares are forests designated for the protection of soil and water.



The afforestation goals are mainly for the control of desertification and the conservation of soil and water resources (agriculture and irrigation), with well over one third of China’s existing forests planted (Chart 17).



China will continue to plant forests under the 12FYP and 13FYP as the country has pledged to increase its forested area by 40m hectares by 2020¹⁷. We expect details of how the increase will be achieved at local level to be released soon and also expect the Government to unveil potential policies which will support the development of the forestry industry, such as loans and subsidies. China already subsidises tree planting in order to reach its stated aim of 26% forest coverage area by 2050.

¹⁶ Global Forestry Resource Assessment 2010, (GFRA 2010), FAO

¹⁷ Note: Compared with 2005 levels. *China’s letter to the UNFCCC*, 28 January 2010

Energy intensity

In this section we briefly highlight energy's reliance on water, energy efficiency in provinces and the new energy intensity reduction targets.

Energy relies on water

The power sector is a major user of water, mainly for cooling purposes. It draws ambient temperature river water to cool reactors and returns slightly warmer water back into the system. Water is also used by hydropower stations. In 2010, hydro represented 16.2% of China's electric power generation.

Power shortages and blackouts are disruptive

This summer China experienced power cuts and blackouts caused in part by high thermal coal prices and a drop in hydropower production. In May water levels in the Yangtze River fell to near record lows – affecting the capacity of hydropower stations along the river.

Power shortages not only affect power producers but also disrupt businesses. The authorities in some regions of China have occasionally increased retail prices in order to lessen the demand on the grid; certain sectors have also had to pay higher prices for power, especially during periods of seasonal demand. This is especially disruptive as many companies are already facing rising costs through raw material price hikes (resource stress) and wage increases (inflation).

Another tactic to reduce demand is the forced suspension of factories. Use of this tactic was widely reported during this summer's shortages; factories had to suspend production for certain days during the week¹⁸.

Using diesel generators increases emissions

The rationing of power also has some unintended consequences. Some factories anticipate the power shortages and purchase diesel generators in order to maintain production. This may present a short term opportunity for manufacturers and suppliers of diesel generators. However, in our view this is not a long term solution and the government is formulating policies to curtail this practice.

In addition, meeting a facility's electricity needs by burning diesel in relatively inexpensive and inefficient generators releases more carbon emissions than if the facility had used electricity from the grid. This all feeds back into the exacerbation of resource stress due to climate change.

Energy efficiency by province

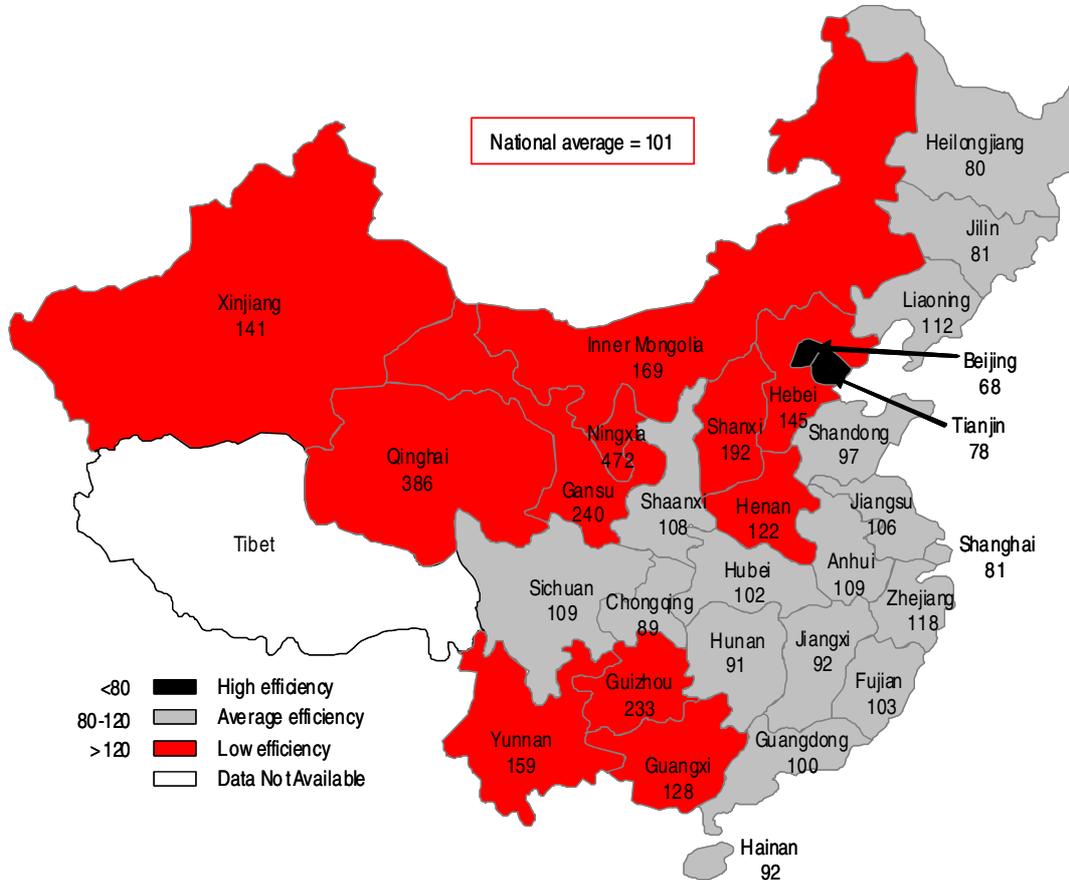
The efficiency of energy use varies widely by province in China (Figure 7, overleaf). The large clusters of red provinces in the north and southwest represent provinces which are least efficient and well below the national average.

Beijing is by far the most efficient region; tertiary industry comprises over three quarters of its GRP. Interestingly, Tianjin is also efficient despite having a large portion of its GRP coming from secondary industry; the breakdown of Tianjin's industry is more likely from higher end (less energy intensive) industry, in our view. Guangdong, the largest contributor to national GDP, is just below the national energy intensity average.

Qinghai and Ningxia are by far the least efficient provinces. Qinghai is near the bottom in terms of provincial development and has a growing extractives industry (lithium, potassium, magnesium) which may not help its energy efficiency. We also note that Qinghai is the source of China's three major rivers (Yangtze, Yellow, Lancang). Power generation, mining, smelting and materials make Ningxia the least efficient province.

¹⁸ "China Limits Manufacturers' Power Use", *Wall Street Journal*, 18 May 2011

Figure 7: Energy intensity (kwh/RMB1,000) in provinces, 2009



Source: HSBC (based on data from China Statistical Yearbook, 2010)

In our view, the government’s strategy of developing the west of China is in line with shifting more secondary industry to lesser populated provinces, so that populous provinces can develop more services industries.

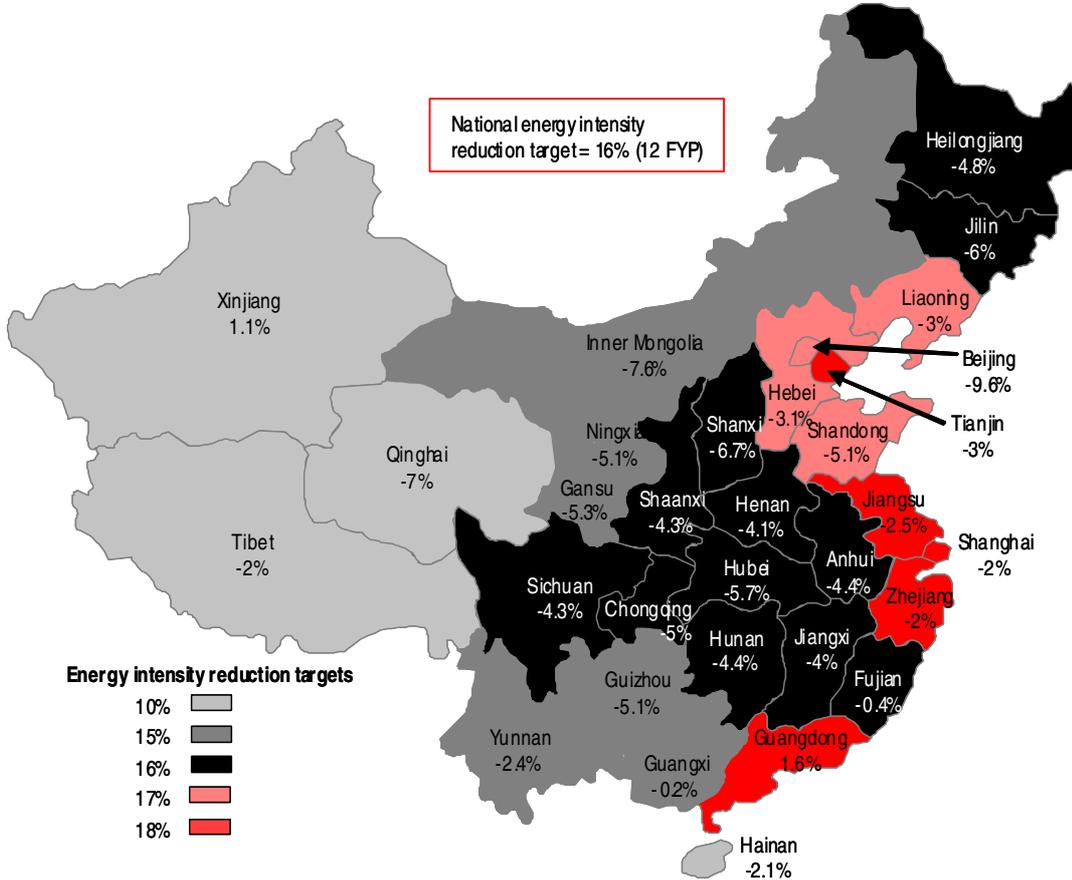
Energy intensity reduction targets

In September the State Council released the work plan¹⁹ detailing how national targets would be reached at the provincial level. The document took much negotiation between the central and provincial authorities; the provincial authorities will then have to undergo similar negotiations with their sub-divisions – the prefecture and county levels.

Figure 8 on the next page shows provinces and their respective energy intensity reduction targets under the 12FYP. The provinces in red may appear to have the strictest targets although we qualify this against the reduction each province already achieved during the 11FYP. Guangdong and Xinjiang are the only two provinces which must achieve a 2015 target which is higher than that achieved by 2010. We believe Guangdong will either need to improve the efficiency of its manufacturing industry or to shift its economy away from manufacturing in order to achieve its reduction target.

¹⁹ Energy Conservation and Emissions Reduction Comprehensive Work Plan for the 12th Five-Year Plan, Annex 1

Figure 8: Energy intensity reduction targets by province; (Labels = reduction target compared to that achieved in 11 FYP)



Source: China State Council

Financing the transition

Besides direct investment into infrastructure and more efficient processes, we also briefly look at some of the other indirect financing methods of moving towards a more resource-efficient economy.

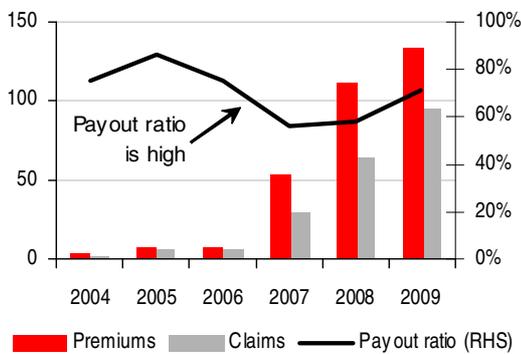
Insurance

In our view, resource stress and climate change increase the vulnerability of the insurance sector. Increasing resource stresses could cause a rise in claims as crops fail due to drought or are damaged by extreme temperatures. Also property and land damaged through extreme events would cause greater losses for the insurance industry as it pays out on claims.

Agriculture insurance has grown rapidly in recent years in China, mainly covering crop damage or crop failure. The strong growth in premiums from agriculture insurance is shown in Chart 18.

Worryingly for the industry, the payout ratio has been relatively high for agriculture insurance and recently claims on this type of insurance have risen faster than premiums.

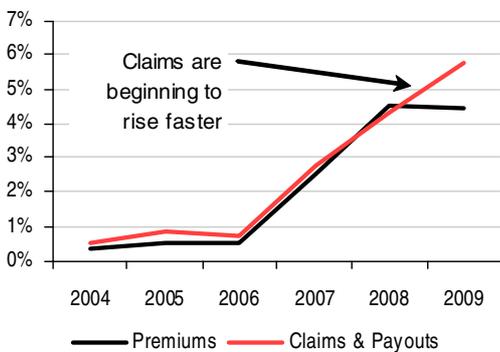
Chart 18: Agriculture insurance is on the rise in China



Source: HSBC (Based on National Bureau of Statistics of China)

Chart 19 examines the contribution of agriculture insurance as a proportion of all non-life insurance in China. Notably, claims from agriculture are beginning to become a larger part of total payouts.

Chart 19: Agricultural insurance as a portion of non-life insurance in China



Source: National Bureau of Statistics of China

The 12FYP “will improve the policy-supported agricultural insurance system, and develop an agricultural reinsurance system and a mechanism for diffusing the risk of huge catastrophes.”²⁰ We expect policies which will shift some of the insurance risk from the public to the private sector to emerge in the next few years and this could be both beneficial and adverse for insurance and reinsurance companies.

²⁰ Main objectives and tasks for the 12th Five-Year Plan, Premier Wen Jiabao, NPC meeting, 5 March 2011

Local banks

We believe the potential mobilization of capital in China during episodes of extreme resource stress could become an issue for financial institutions, especially some smaller local banks.

During the height of the drought this past winter, Beijing pledged RMB13bn to combat the drought. Banks were told to lend money to farmers to enable them to dig emergency wells, buy farm and irrigation equipment as well as seed, fertilisers and pesticides. This was despite a nationwide increase in the required reserve ratio. The People’s Bank of China provided RMB10bn in loans to financial institutions in drought-hit provinces, guiding them to provide loans to farmers.

Although the magnitude of these loans is insignificant when compared to the generic loan book of banks, it could have an impact should resource stress become more acute, or a large enough event occurs.

Conclusion

We believe that resource stresses are real in China and that climate change makes these stresses more acute. China is responding to the challenge of climate change and we believe it is time investors and companies followed suit.

Disclosure appendix

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