



CHINA'S LOOMING WATER CRISIS

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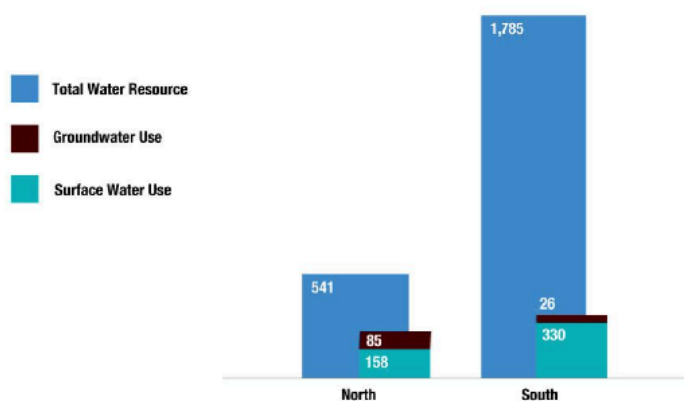
SOUTH-NORTH WATER TRANSFER PROJECT (IMAGE: SNWTP OFFICIAL SITE)

INTRODUCTION

Optimism or pessimism about the future success of Xi Jinping's new era may be in the mind of the beholder. The optimist will point to the Party's past record of adaptability and problem solving; the pessimist will point out that no longer are the interests of reform pointing in the same directions as the interests of Party cadres, and certainly not of some still powerful vested interests. But whether China muddles or triumphs through, few are predicting that problems such as debt, overcapacity, housing bubbles, economic rebalancing, the sheer cost of providing social security and services to 1.4 billion people will cause severe economic disruption or the collapse of China.

However, one threat, if not tackled, does have that potential: the scarcity of water in the north. While you can move water and substitute it by importing goods that use a lot of water in their manufacture, there are limits. A holistic approach is necessary and urgent.

2011 North-South Water Use vs Total Water Resources (billion m³)



SOURCE: CHINA
WATER RISK

HOW SERIOUS IS THE PROBLEM?

Very. Back in 2005 the Minister of Water Resources reportedly told journalists of the need “to fight for every drop of water or die, that is the challenge facing China”. Ex-Premier Wen Jiabao said that water shortages threatened “the very survival of the Chinese nation”.

But first some definitions and statistics (a wider set of figures are given in the attached appendix; note that they are mostly Chinese government figures, which, while worrying, are less so than those put out by the Asian Development Bank, China Water Risk, and Scientific American).

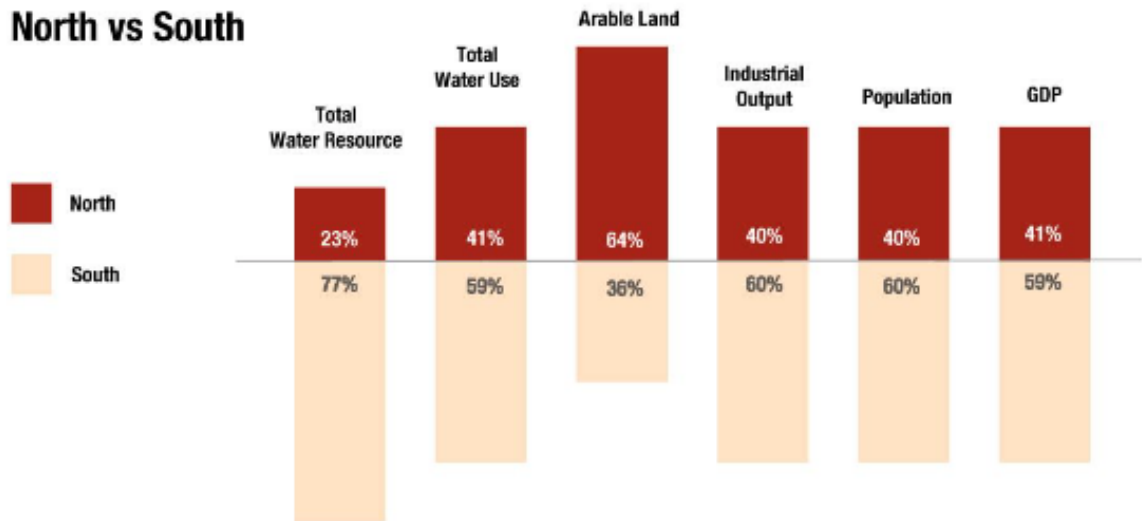
Water stress is commonly defined as beginning at less than 1,700 cubic metres (m³) per person per year for all water consumed directly or indirectly (from power generation, manufacturing goods, food provision to teeth cleaning). Water scarcity starts at 1,000 m³ and acute scarcity at 500 m³. In

**CHINA HAS 20% OF THE
WORLD'S POPULATION BUT
ONLY 7% OF ITS WATER.**

2014, China's overall per capita renewable water resources were 2018 m³ (and less now). Overall per capita consumption in 2012 was 1,207 m³ (*Scientific American*) or 1028 m³ in 2016 (China Statis-

tical Yearbook (CSY)). The 13th Five Year Plan calls for an annual limit of 670 billion m³, which divided between a population of 1.4 billion equates to consumption of just over 600 m³ per capita.

North vs South



HOW WATER RESOURCE AND USAGE DIFFER BETWEEN NORTH AND SOUTH CHINA. SOURCE: CHINA WATER RISK

Overall water resources are not significantly more constrained than those of the UK. The problem however is their distribution: that 80% of the water is in the south. Eight northern provinces (order, according to CSY: Tianjin, Ningxia, Beijing, Shandong, Shanghai, Hebei, Henan, Shanxi) suffer from acute water scarcity; and four from water scarcity (Gansu, Shaanxi, Liaoning and Jiangsu). The famed 'JingJinJi' region of Beijing, Tianjin and Hebei, Xi Jinping's northern development base with over 120 million people, comes in at a figure of under half of acute water scarcity, with Beijing and Tianjin not much better off than Saudi Arabia. Xinjiang and Inner Mongolia, which contain large areas of desert, are also short of water, but have small populations. Xinjiang in particular is an agricultural centre using irrigation, a sector heavy in the use of water. Finally, 85% of China's coal reserves are in water scarce provinces; coal mining is consumptive of water and highly polluting. As a final twist, most of these coal reserves overlap with big agricultural bases.

Current usage is unsustainable. Countrywide, agriculture consumes 62% of water, power/industry 22%, humans 14% and other use 2% (e.g. replenishment of lakes). The 12 provinces listed above represent 38% of China's agriculture, 50% of its power generation, 46% of its industry and 41% of its population (CSY 2017). Groundwater levels are falling fast: in 2015 over 230,000 square kilometres (sq. km), about 4% of China's land was suffering from overexploitation; the exploitation rate of the three main northern rivers the Hai, Yellow and Liao in 2015 were 106%, 83% and 76% compared to the world recognised security limit of 40%. The outflow of the Yellow River, China's lifeline in the north, is 10% of what it was in the 1940s and in most years large stretches are dry. Groundwater levels are falling fast in the north, by 1-3 metres a year. One of the effects of overuse is that aquifers collapse, which reduces the capacity to refill when rains are good.



COUNTRYWIDE, AGRICULTURE CONSUMES 62% OF WATER; 22% GOES TO INDUSTRY. (IMAGE: FERAUGUSTODESIGN)

THE PROBLEM IS EXACERBATED BY POLLUTION AND INEFFICIENT USE

Air pollution grabs the headlines and the nostrils, but water and soil pollution are more intractable and far more expensive to cure (Ma Jun of the Peoples Bank of China said in 2015 that if China continued to spend the current amount on rectifying soil pollution, it would take 10,000 years – perhaps not literally: “yi wan nian” is Chinese for a very long time indeed – to achieve). The flip side of China’s impressive growth has been its disastrous degradation of the environment. At the 18th Party Congress Xi Jinping gave the environment a major part; at the 19th he put it centre stage. Water shortage is a major reason.

A lack of inspection, transparency, enforcement and punishment (it has been cheaper to pay fines than to follow regulations) has led industry and mining to pollute on a heroic scale (see annex 2 for the main areas to be controlled). Add to those livestock and poultry slurry, overuse of pesticides, unsupervised dumping, and water quality is still bad [deteriorating]. In 2015, 9.2% of surveyed water was unusable, i.e. worse even than level V, water which cannot be used in agriculture or industry. Recently figures of 8.8% and even 8.3% (NDRC report at the March ‘Two Sessions’) have been given for the end of 2017. Some progress, but still shocking figures.

In 2014 the figures for “bad” and “very bad” (levels IV and V) groundwater were 61.5%, up 1.9% over 2013. In 2007 along 33% of its length the Yellow

River was unusable for industry or agriculture; the situation will have deteriorated further until the last few years.

Inefficient usage exacerbates the problems of water scarcity. 50% of water used in agriculture is wasted through poor irrigation and backward farming practices, according to the Chinese government. That is over 30% of all

TECHNICAL SOLUTIONS ARE NOT SUFFICIENT TO SOLVE SHORTAGES

Much is made of the South North Water Transfer Project (SNWTP) as a potential saviour of the north. To put it into perspective, groundwater monitoring data released by Ministry of Water Resources (MWR) in December 2014 showed an overall decrease over 2013 of more than eight billion m³ in groundwater reserves (i.e. not including surface water) in the northern plains, which is over half of the SNWT's current capacity. So at best it buys a little time.

Its two already functioning arms will be able to move an annual 20.9 billion m³ by 2030, although this does not account for the power, and therefore water, consumed in raising the water over terrain 600 metres high in the east and in operating 474 pollution filtering stations. But even if this operating target were met and all 20.9 billion m³ of water were sent to the Beijing/Tianjin/Hebei area, it would only raise water per capita to around two

thirds of acute water scarcity. But not even that level will be reached, because the water has to be shared also with Shandong, Jiangsu, and Henan provinces. And most likely resolving the water crisis will not wait until full transfer capacity is reached in 2030.

Other water transfer projects will not be practical, let alone deliverable in time to avert a water crisis. Talk of projects that will transfer water from Lake Baikal in Russia and from the Brahmaputra River in Tibet to Xinjiang or into the Yangtse River is fantasy, as a quick glance at a topographical map shows. The age of engineers dominating the Politburo Standing Committee and using grandiose engineering feats to solve China's problems is past (if it were ever present).

Desalination is often suggested as a solution. This does not make sense given the size of agricultural and industrial demand. It hardly works for even personal consumption. The power needed to desalinate a cubic metre of salt water and move it from the

coast inland requires the consumption of roughly half a cubic metre or more of water in its generation (rising to over 75% if water cooling is used). That assumes coal-fired power stations,

as they must be, given that rising demand for power outstrips the ability to bring on stream non-fossil sources, most of which is not in the eastern part of the country where it is needed.

*80% OF THE WATER IS
IN THE SOUTH, BUT MORE
THAN 50% OF THE PEOPLE ARE IN THE NORTH*

A more realistic solution might be high voltage transmission of power over long distances to the developed eastern agricultural, industrial and populous provinces. Unfortunately, so far the technology is not there to allow solar and wind power to come from Xinjiang, Gansu etc., or hydropower from Tibet or Yunan. (There are other very severe ecological problems caused by dams, particularly mega-dams: greater pollution from reduced river flows, greenhouse gases from rotting vegetation covered by the back waters, depriving lower regions of vital nutrients usually brought down in the flood seasons, more subsidence, serious water loss through evaporation from the vast surface water area behind dams. To say nothing about the wisdom of building dams in high risk earthquake zones: not only is there evidence that the weight of water precipitates and worsens earthquakes, but the result of a mega-dam breaking would be catastrophic.)

There are two common counter arguments to being disobliging about desalination: Israel does it; and it is possible to conceive of a China in the future where non-fossil fuel power generation is sufficient to meet the power needs of desalination plants. But Israel is much smaller, has a different economic, industrial and agricultural structure, highly advanced agriculture and irrigation technology, rationing through price. China has highly water consumptive industries, inefficient agriculture and poor pricing. Changing that is part of the reform programme, which, even if it proceeded apace, will take China beyond Xi Jinping's first goal of 2035 announced at the 19th Party Congress. So there is unlikely to be the luxury of 18 years time.

For the second argument, China has done remarkably well in developing

hydro, solar and wind power generation (discount nuclear: it uses nearly as much water as coal). But those sources will not be able to meet the heavy demands of desalination, both because there is not the space to place them in the east where they are needed; because military and other interests such as shipping and fishing hamper the development of offshore wind farms; and because developing high voltage transmission technology in order to bring electricity from the west will not happen in time (even assuming that the central government can sort out the protectionism of provinces and the grid).



SOME LOCAL INDUSTRIAL ACTIVITY HAS BEEN BANNED TO ENSURE WATER QUALITY FOR THE DANJANKOU RESERVOIR (IMAGE: SNWTP)

WHAT ARE THE CONSEQUENCES AND WHEN MIGHT THEY HIT?

Clearly if a sudden water crisis were to hit (would a few years of severe drought be sufficient to cause it?), some very hard choices would be forced upon the government between agriculture, power generation, industry and every day use by the people. Those choices still need to be made now, given that falling renewable water resources render the situation unsustainable. The threat is worse than just to food security, economic prosperity and social well-being: the likelihood of those and other factors leading to large scale unrest is something which must terrify the Party.

The consequences of water scarcity are with us already. In 2016 when the Beijing Mayor announced that the city's population would not be allowed to rise over 23 million, the first reason he gave was a lack of water. A 2016

**BEIJING'S WATER TABLE
HAS DROPPED 100-
300 METRES SINCE THE
1970s** - *Economist* 10 Oct 2013

article on Lintao, a new town in Gansu of several million inhabitants discussed the problems of new buildings where residents had access to water for only an hour a day and must carry it up to their high-rise flats. By 2017 the same

problem was afflicting the provincial capital of Shanxi Taiyuan (population over four million): even international hotels have water for only an hour or so per day and its famed vinegar industry, an indispensable accompaniment

to Beijing's famed dumplings, is in trouble from lack of water. Meanwhile in the capital of Henan, Zhengzhou, a city planned to grow from three to seven million inhabitants by 2020, there were two water supply crises in 2014 and of seven water processing plants planned only one is being built because water sources have dried up.

Some consequences are unlikely to be visible until too late. Subsistence reduces aquifers, exacerbating the problem of water supply. Overwithdrawal from coastal aquifers allows seawater intrusion, further reducing supplies. Over 50 cities are threatened by subsidence as a result of groundwater withdrawals. The government monitors this closely, because it could make some buildings, transport or land unusable, to great economic cost (imagine the cost of subsidence affecting a high speed rail line or of a business district office block). At present parts of Beijing are subsiding at around 11 centimetres a year.

It is not possible to say when water scarcity will cause economic dislocation. Until water runs out, life continues much as normal. How much time the government has to take effective action depends also on unpredictable elements such as rainfall. But what is certain is that not only must the Party stop the increase in demand, it must actively reduce it from current levels. This will not be easy at a time when more and more people aspire to middle class goods and lifestyles (UK per capita water consumption is nearly double Chinese. If Xi's "moderately prosperous society" is ever to approach ours, it must be done with double the water efficiency.)

WHAT IS THE GOVERNMENT DOING?

The Party is certainly deeply conscious of the threat, as the leaders' comments at the start of this paper underlined. It is interesting to speculate why the topic is not often aired. The answer may lie in its sensitivity and the difficulty of making a difference without measures which would be deeply unpopular and disruptive; also the Party does not like to talk of problems until it has worked out solutions). There are plans and aspirations, not only reflected in the 13th FYP, but in others, notably the 2013 'Water allocation Plan for the Development of Coal Bases' and the 2015 '10 Point Water Plan', which sets specific targets and, for the first time, includes a designated ministry responsible for each measure, as well as other ministries which must be involved. The '10 Point Plan' concentrates largely on reducing water pollution, promoting recycling to increase supply. The measures are less impressive when it comes to reducing demand: for example, the target for irrigation reduction by 2018 is 3.7 billion m³, around 0.5% of the 2020 target for total water consumption.

Generally, most measures are related to the supply side, particularly water transfers and attempts to stop pollution reducing supplies. For the latter, the legal framework has been strengthened through the Environmental Protection Law, the training of courts in environmental law, and the introduction of environmental targets in cadres' career assessments, which in some water scarce areas have replaced economic growth targets. At present the government is finalising a 'River Chief System' and a 'Lake Chief System',

which designate an official as in charge of the use of and pollution of rivers and lakes for a specified time, a responsibility which is intended to stay with him/her for life.

Investment in improving irrigation is important, because agriculture consumes 62.5% of all water and wastes half of that. In 2015 the government announced it would invest 800 billion yuan (about US\$127 billion) in 27 major water conservancy projects, many to improve irrigation.

More generally, the amounts of money being invested in the control of pollution and in recycling are enormous. According to the NGO China Water Risk, during the next few years, the government will invest over six trillion yuan, two thirds on water infrastructure and one third to tackle water pollution.

Recycling and using waste water in other compatible industrial processes are being set down in regulation and are major growth industries. Urban water reuse rates are to rise to 20% by 2020 (30% in the Beijing/Tianjin/Hebei area), public buildings above 20,000 square metres must now be built with water reuse facilities within them; the same applies to public housing.

In 2015 the government announced a programme of "sponge cities", where infrastructure would be built to capture rain. The problem is that most cities in the north receive little annual rainfall and most of it within the space of a few months.

Non-fossil fuel power generation is being pushed, although, as mentioned above, the distance between major population centres and areas where

sunshine, wind and hydro resources are most plentiful is too great to effect a revolutionary change. Nuclear power is not a potential saviour, certainly inland, because it consumes much the same amounts of water as coal fired power stations. While that it is not so on the coast, the Fukushima disaster has shown the dangers there.

Some local governments are more active in publicity about the need to save water than others (oddly the message seems not to be coming across loudly in Beijing), but attempts to change people's behaviour lag behind the seriousness of the issue. Inspection, the perennial solution for the top-down favouring Party, is being stepped up, particularly of pollution. The closing of air polluting plants, mainly steel, is not aimed at saving water, but has that effect.



A SPONGE CITY PROJECT IN DESIGNED BY TURENSCAPE: YANWEIZHOU PARK IN JINHUA CITY (IMAGE: TURENSCAPE)

WHAT IS THE GOVERNMENT NOT DOING AND SHOULD BE DOING?

No matter the sector, the most necessary change is to ration water demand by price. In 2011 the average price per cubic metre was less than a quarter of the world average. Since then price rises have been marginal. Indeed, when in April 2013 the head of the China Water Investment Company declared that prices needed to be raised “many times”, because “nothing

“ *POLITICALLY, RAISING WATER PRICES WILL BE VERY TOUGH*

else would work”, he was quickly silenced, the government fearing protests by the people. Yet the nettle must be grasped – and quickly. For without making wast-

ing water more expensive there is no incentive for people to change their habits; furthermore the implicit subsidy in cheap water reduces the incentive for industry or agriculture to become more efficient.

Politically, raising prices will be very tough: farmers are poor and not used to paying for water; many already struggling industries which are high consumers of water or power, especially state-owned enterprises (SOE), would be pushed further into the red or into bankruptcy, or pressure would increase on already financially struggling local governments to raise subsidies for inefficient SOEs; very many ordinary urban citizens would find a sensible price rise hard to bear, small private urban businesses might fold. When it comes to raising the price of household water, not for the first time

the National People's Congress Work Report has promised change. Unemployment and inflation, which could lead to unrest, are what the Party fears most. It prefers to kick the water can down the road.

The second task is better governance. Oddly for a government which talks of its superiority in decision making and speed and which has numerous Leading Small Groups (LSG) to co-ordinate areas of policy, there is no water LSG (there is only one LSG on the environment, the Climate Change Energy Conservation and Emissions Reduction LSG). The 19th Party Congress announced a new body to co-ordinate the use of natural resources. We shall see if this makes water a priority. It should be. At least "9 dragons" (ministries) are involved in any decision on water. The Ministry of Water Resources and the Ministry of Environmental Protection do not exchange information on an automatic basis (information is power and money) and one controls water in rivers, the other water as soon as it leaves a river. They should be amalgamated. First announced in February 2013, the "Water Pollution Action Plan" took 27 months to produce (implementing it will take longer).

By overlaying a map of planned and in construction coal fired power stations on a map of water scarcity Greenpeace has shown the absence of planning, which they confirmed with the National Energy Agency. A report that in 2018, 8.5 billion tonnes (others suggest around half of that) of aluminium processing will come on line is worrying: while it did not say how much will be in water scarce provinces, it is likely that some will. Aluminium smelting requires much power, and therefore water.

In specific areas of water consumption there is much more the government could attempt.

In agriculture:

- » Land reform. Apart from the state farms on the coast and in the north east, plots are miniscule, discouraging investment: 95% of Chinese farms are under two hectares (compared with India at 85%. Of course, this is a very rough comparison, because what matters is the percentage of overall land in large farms, rather than the number of farms). Aggregation of plots is happening by default but it requires land reform, which has not progressed, partly for ideological reasons (the Party's rise to power was on the back of promises to the peasantry to give each person a stake; reluctance to abandon collective ownership may also impinge on vested interests), partly because it requires a complex reworking of local government financing.
- » Drip feed irrigation is essential, but expensive. Farmers are struggling financially, local governments are already suffering a debt crisis. That leaves central government funding, which will as ever be difficult to deliver effectively at the village or individual level. Funding has been increasing (2015 800billion yuan in 27 major water conservancy projects, many to improve irrigation); it needs to go much higher.
- » Further abandon the food security policy. Until recently this has been a staple of the Party's political diet: it has clung to the line that it must be self-sufficient in the five major grains. It is now moving away from that insistence, although it still holds to a red line of arable land (120 million hec-

tares) necessitating an increasing area of irrigation, usually of marginal land, to replace land used for expanding cities. More meat and grain must be imported: meat uses around 15 times more water per kilo than rice, which is itself a heavy consumer of water (1,000-1,500 litres per kilo) compared to wheat.

» A move away from water consuming crops to drought resistant ones (less meat, cotton, rice and wheat, more of the humble potato, consumption of which is being encouraged, although changing dining preferences will be a gastronomic and cultural struggle). Research in water light strains of crops is a priority – and ongoing.

On industry:

The priority must be to move as swiftly as possible from power (water) consuming and polluting industries, such as steel, aluminium, paper, textiles, leather, dyeing to high tech manufacturing and services. Where possible – this is after all an economy where central control still plays a part, although market/pricing should also be allowed to encourage in the same direction – power/water consuming industries should be located in the south of China. The government needs to continue work to incentivise industry to introduce water saving technology and to make polluting and inefficient water usage more expensive than proper treatment of discharges. It must devise policies to raise industry's water efficiency; currently China uses 2-3 times the amount of water per unit of value produced compared to the average of the world's advanced countries (Deputy Chief Engineer of the General

Institute of Water Resources and Hydropower Planning and Design). Others have put the figure higher: in 2010 water productivity was US\$5.3 per m³ compared to a developed world average of US\$35. (Climate Group think-tank)

On power generation

The priority must be to reduce demand, mainly by pricing, but also by other incentives/measures, not least by removing provincial grid barriers to full utilisation of non-fossil fuel energy based in other provinces. Only thus can plans to add a further 140 gigawatts of coal based energy by 2020 be reversed, equivalent to twice the current electricity consumption of the whole of Shanxi province and its 37 million people). Research into long distance power transmission must become the top priority.

On everyday use

The government must devote far more of its considerable propaganda resources to explaining the need to save water. More needs to be done on the problem of leaking pipes. No one in China trusts the tap water: 40% of urban residents drink bottled water, more would wish to. The pollution this causes in discarded plastic bottles is enormous and a threat both to land and to the world's oceans, to say nothing of the energy (and thereby water) wasted in

***IN 2013, 140 MILLION
PEOPLE WERE WITHOUT
ACCESS TO SAFE DRINKING
WATER*** - JINGJI CANKAO 14 APRIL 2014

the process of filtering, bottle making and transporting.

Finally, despite the negative news on water, which contradicts Xi Jinping's push for "positive energy", far more transparency, information, testing, monitoring and discussion needs to go on, to sensitise people to a problem which must transcend Party politics and interests.



40% OF URBAN RESIDENTS DRINK BOTTLED WATER. (IMAGE: WIKIMEDIA)

CAN XI JINPING STAVE OFF A WATER CRISIS?

The determination expressed by Xi Jinping at the 19th Party Congress to ensure “more balanced and adequate” growth is an important recognition of the need for sustainable development. Along with alleviating disparities, Xi has put the environment at the top of political priorities (although all comes second to the need for stability and Party survival). He has empha-



**RAISING WATER PRICES REMOVES
A SUBSTANTIAL SUBSIDY TO
BUSINESS AND AGRICULTURE**

sised that GDP growth is no longer the main determinant of promotion; the environment is taking over. On the other hand, he has invested personal prestige

in the Xiong’an city signature project in Hebei, which a leading member of the Development Research Centre of the State Council described this month as unwise, amongst other reasons, because of the lack of water and the pollution.

It is not possible to say when the water will run out if policies and measures prove insufficient. Drought would hasten the date, good rains delay, but not avert it. But dislocations are already occurring. In the absence of vigorous and rigorous action, the chances of Xi Jinping achieving his announced goals for 2035 and 2049 are negligible, and even that of a “moderately prosperous society” by 2020 could be in doubt.

The good news is that the problem has been recognised in the 18th and 19th Party Congresses, in the 13th Five Year Plan and in other plans; great progress has been made in monitoring, publishing information, drawing up legislation and regulations, incentivising officials; China is not short of funds; and politically, Xi Jinping has given his full support by declaring a “new contradiction” and the priority of quality growth.

Finally, in the longer term, as Michael Pettis, Professor of Finance at Guanghua School of Management, Peking University has pointed out, raising water prices removes a substantial subsidy to business and agriculture, which is basically a hidden transfer of wealth from households to business. This is a major cause of the imbalances in the Chinese economy, which Xi Jinping has vowed to remove. By removing this subsidy and thereby reducing implicit fiscal expenditures, more money can be channelled to the household sector consumers, which would be positive in rebalancing.

However, the short term risks are not small, particularly when China faces the problems of a slowing economy. The time in which change must occur may itself be short. The practical, scientific, economic and social problems

“*CHINA CAN PRINT MONEY, BUT IT
CANNOT PRINT WATER*”

are innately complex. They are also politically difficult: in the words of one

scientist, “We know the problems and the solutions, but above us there is politics.” Indeed. The system is top down and the Party refuses to trust civil society, a free press, an independent judiciary and political accountability,

for fear that such tolerance would lead to the growth of other power centres or influences, which would affect its monopoly on power. Yet without the help of other forces in society and their acceptance of the necessity of fast change, with all its inconveniences and sacrifices, it is doubtful that the Party will succeed. Xi will need to take increased domestic risks, despite the evidence so far, that when it comes to the possibility of popular protest or alienating the middle classes, he has shied away from tough domestic decisions (a faster rate of bankruptcies/unemployment in zombie companies and the long postponement of the property tax are prominent examples). And he will need to be truly resilient in taking on the famous vested interests, which have benefitted from the old, unsustainable model.

This is the one problem where China's financial muscle will not save it, no matter how much water it substitutes by imports: it can print money, but it cannot print water. Unspoken, water is at the heart of Xi Jinping's new contradiction of 'unbalanced and inadequate' development. There may still be time – and water – but both are running out.

GLOBAL IMPLICATIONS

China's success, or lack of it, in dealing with its water crisis has enormous implications not just for itself, but also for the rest of the world. Failure would greatly affect world trade, investment and employment; in the worst case, legal and illegal migration levels could rise. Success is a prerequisite for China achieving by 2049 its "centennial" goal (100 years from the founding of the People's Republic) of becoming a strong, modern, socialist state, and fulfilling its ambition to be the pre-eminent global leader.

The most obvious effect will, or is already, on sharing "transboundary water". This is a subject worth a paper in its own right. But whether it is the Ili and Irtysh rivers flowing into Kazakhstan, the Brahmaputra and Sutlej into India, or the Mekong, Salween into South East Asia, if China uses increasing amounts of the those waters, which flow first through its territory, there will be economic, agricultural and social consequences downstream. This is already a cause for tension; and that is only likely to worsen. While China will not welcome western involvement in Asian affairs, Europe and the United States do have important interests and therefore a place in trying to resolve water quarrels.

The water crisis makes all the more important China's industrial policy "Made in China 2025". If a lack of water forces the Chinese economy to move swiftly away from power/water consuming industries, such as steel, aluminium, clothing, paper, that increases the urgency of developing new

high technology industries and the service sector to replace them. So water joins demographics in pushing forward innovation and the need for education and training. There are likely also to be important effects on the demand for raw materials, such as iron ore or bauxite. These shifts will also affect the global economy.

China's investment abroad may also be affected. A natural reaction to the water crisis would be to buy up technology which either increases water supply (e.g. by reducing pollution or by recycling) or decreases demand. Given the equation that power is water, the latter can be defined fairly widely. We should expect more approaches to buy firms with technology which saves on water, power or pollution.

The global market for agricultural products will also be affected. China is already quietly stepping back from its policy of food security, from being 90% self-sufficient in the "five grains". Increasingly it will have to buy food on the world market. Attempts to own land abroad are already affecting



*CHINA IS ALREADY QUIETLY
STEPPING BACK FROM ITS POLICY
OF FOOD SECURITY*

countries in Europe, Africa, Australasia and even in tiny Chatham Islands, where a sheep station now has a Chinese owner.

There is no evidence to suggest that Chinese leaders have conceived of the Belt and Road Initiative (BRI) as means of relieving the effects of China's water northern shortage. But they may come to see it as helping. Relocating

power/water consuming industries to BRI countries (rather than in western China, which is topographically and hydrologically unsuitable) would bring them closer to world markets and to better water resources. One must hope that the Chinese do not replicate their own water problems by setting up industries in countries such as those in Central Asia which are also suffering from water scarcity.

GLOBAL OPPORTUNITIES

If the implications are generally concerning, China's need to readjust to its water realities also brings opportunities.

On a strategic, diplomatic level co-operation over water, pollution, recycling, sharing expertise in river and lake management, environmental governance is a way of building trust. These are areas which really matter to China's future. In a world of growing conflict of interests finding such common ground may help to ease tensions.

For academia and the science and technology world, a joint approach in research and development might also bring mutual benefits.

In 2015 then Minister of Environmental Protection Chen Jining said at his National People's Congress press conference that "Environmental protection is an important growth driver for China and the demand for investment will be huge in the years to come." That should be an opportunity for foreign

companies not just in the water, recycling, waste disposal industries, but in other areas where their products and technologies can save power, water or pollution. The size of the China market allows economies of scale which make the development of new technologies by foreign companies financially viable, thus helping future competitiveness and job creation. As ever, success will be contingent upon greater reciprocity, better IPR protection and a level playing field in trade and investment relations. And perhaps China's imperative to adjust to water scarcity might make this a good area to use as a lever to achieve a fairer deal for foreign companies.

ANNEX - SOME FACTS ABOUT THE WATER SITUATION IN CHINA

Note: some government figures may be deliberately understated.

Overall

- » China has 20% of the world's population but only 7% of its water.
- » 80% of the water is in the south, but 64% of the farmland and >50% of the people are in the north.
- » Accepted definitions of water stress/scarcity and acute scarcity are respectively 1,700m³/1,000 m³/500m³ per person per year for all uses, direct and indirect.
- » Total planned water use in 2015 of 620 billion m³ or about 445 m³ per person per year. (12th FYP statistic) In 2012 there was a 50 billion m³ shortfall. (MWR) Water usage to be held to below 670m³ per person by 2020.
- » From 2000-2009 total water reserves dropped 13% (12th 5YP statistic)
- » Since 1970 groundwater usage has doubled and in 2013 made up 20% of water usage (Chinese Geological Survey Bureau).
- » Over 300 out of 657 cities have water resources below the WB standard for water stress

» On 3 of the 7 major river systems (Hai, Yellow and Liao) exploitation levels have reached 106%, 82% and 76% against the internationally recognised maximum of 40%. (MEP official reported in Jinghua Shibao 17/4/15)
28,000 rivers have disappeared across China in the last 20 years.

Beijing and the North

» 12 provinces suffer water scarcity, of which 8 suffer acute scarcity. All are north of the Yangtse.

» The average amount of water resources per Beijing resident was 300 m³ in 2008 (CASS Bluebook). By 2012 it had fallen to 119 m³, and is now less than 100 m³. Average for north China 300 m³ (Vice-Min MWR 21.3. 2013 Zhong xin wang)

» The 2016 figure for Beijing/Hebei/Tianjin is approximately 234 m³. (China Statistical Yearbook, incl SNWT transfer?)

» The South North Water Diversion Project's East and Central routes may deliver 20.9 billion m³ of water per year by 2030. If all went to Beijing/Tianjin/Hebei (it does not), their water sources would increase by approximately 186 m³ per year, giving a total of about 420 m³ per year (c. < 300m³ for Beijing).

» Beijing's population grew by c.500,000 per year up to 2013, but will be capped at 23 m.

» The Beijing water table has dropped between 100-300 metres since the 1970s (Economist 10 Oct 2013)

To make matters worse - pollution

» In 2005 70% of the water in 5 out of 7 major river systems was too contaminated for human use. (State Environment Protection Agency) In 2014 three rivers had over 40% of their water graded at level IV or worse, one at 55% and one at 61%. (Zhongguo xinwen wang 11 Nov 2014)

» Of 13,500 km of the Yellow River basin system, 33.8% of water was worse than the UN's level V, ie unfit for agricultural or industrial use. (2007 Yellow River Conservancy Committee survey)

» There are over 20,000 petrochemical plants built next to rivers, 10,000 on the Yangtse and 4,000 on the Yellow River (Vice-Minister of MWR: People's Daily 17.2.12)

» About 20% of water is too polluted even for agricultural or industrial purposes. (Vice-Min of MWR Feb 2012)

» Groundwater: a 2014 survey of 202 cities and 4,896 test sites found that 45.4% of water was 'relatively bad' and 16.1% 'extremely bad'. Compared to 2013 standards had risen in 16.7% of cities, but fallen in 18%. 2013 survey from 4,727 testing sites in 200 cities China showed 45% were at levels I-III, 55% at levels IV-V, i.e. agricultural and industrial use only (10 May 2013 MWR)

» Since 1995 there have been 11,000 water pollution incidents, including 60 'serious' ones in 2014 (MEP official reported in Jinghua Shibao 17/4/15)

Drinking Water

» In 2013 140 million people were without access to safe drinking water. (Jingji Cankao 14 April 2014)

» In Beijing, Shanxi and Hebei (c. 112 m people), over 50% of groundwater was level V or worse; only 25% was fit for human consumption, even after treatment. (MoHURD survey Feb 2013)

» About 90% of Chinese cities tapping into polluted groundwater, of which c.66% was 'severely polluted' (2013 China Geological Survey report)

» Only 50% of urban water qualifies as safe (Nov 2012 Chief Engineer of Urban Water Quality Monitoring Centre of the MoHURD. nb. he excluded level III water, unlike the MEP and MWR)

Inefficient Use

» Industrial recycling rates: 40% (cf EU c. 80%)

» Recycling in large cities: to be raised to 20% by 2020

» Agriculture/irrigation wastes 30% of China's water resources. Uses 63% of water resources, c.50% is lost through evaporation, leaks etc (HSBC report). 95% of farms are less than 2 hectares (86% in India)

» Industrial water consumption per \$1 of new output fell by 37% exceeding

the 30% target in the 11th 5YP (2006-10). The same target is in the 12th 5YP (2011-16).

» In 2010 China's water productivity was \$5.3 per m³. In the developed world the average is around \$35. (Climate Group think tank)

Finance / Costs

» The central government spent around 98.7 billion yuan on water conservancy in 2010. Plan was spend double that amount each year until 2020. In 2015 800 billion yuan was to be spent on 27 major projects.

» The South North Water Transfer Project (SNWTP) had cost 57.8 billion yuan by the end of 2011. Total projected cost over 50 years will be around 486 billion yuan.

» In 2009 the World Bank estimated that the water crisis was costing China 2.3% of GDP.

Human Costs

» Since 1949 water projects have led to 22.9m people being relocated. (Wen Jiabao NPC report 2007)

» The Three Gorges project: 1.4m people moved during construction, plus a further 300,000 subsequently because of land erosion and instability problems.

» SNWT project: 370,000 moved in Hubei and Henan provinces.

» Deaths through cancer and disease: unknown

ABOUT THE AUTHOR

Charlie Parton spent 22 years of his 37 year diplomatic career working in or on China, Hong Kong and Taiwan. In his final posting he was seconded to the EU Delegation in Beijing, where, as First Counsellor until late 2016, he focussed on Chinese politics and internal developments, and advised the EU and Member States on how China's politics might affect their interests. He has also worked in Afghanistan, Cyprus, Libya and Mali. In 2017 he set up his own consultancy, China Ink, and was chosen as Specialist Adviser on China to the House of Commons Foreign Affairs Committee. He returned to Beijing for 4 months as Adviser to the British Embassy to cover the Communist Party's 19th Congress. He is a trustee of Chinadialogue, a NGO which focuses on China's environmental issues, an Associate Fellow of the Royal United Services Institute, and has recently been chosen again as Specialist Adviser to the FAC.