

Sustainable Urbanization

Urbanization and its Impact on China's Water Resources

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Thirst4Water, a partner of the Paulson Institute, is an NGO that educates and engages the next generation of global consumers to become more water-wise by encouraging them to participate in workshops and social media campaigns.



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Introduction

In 1999, when he was still deputy prime minister, Premier Wen Jiabao pointed to China's ability to deal with its limited water resources—out of all of the country's many environmental challenges—as perhaps the largest determining factor in the survival of the Chinese people. Though not entirely without freshwater reserves, sheer population size dictates that China has never been a water abundant country on a per capita basis. And in the past few decades, rapid development, inefficient water usage, and pollution have created a severe and growing water shortage.

If not managed properly, China's new emphasis on urbanization will exacerbate the country's already severe water problems. In the spring of 2014, the government announced a National Urbanization Plan, with a goal of having 60% of the country's population living in cities by 2020. Urbanization is a key component of the government's effort to refocus the economy on a more sustainable model of development. In the next decade, China will add 350 million people to its cities—the backbone of this next phase of growth and prosperity. It is critical that this path to development is pursued while ensuring the availability of safe, clean water to both urban and rural dwellers.

The challenge will be to urbanize while easing pressure on the mega-regions that generate the majority of the nation's GDP. Encouragingly, there are signs the central leadership is committed to looking after the environment: the plan is to be carried out in adherence to the principles of “green, clean, low-carbon development.”¹ However, local and provincial governments will be left to implement and manage the 42 trillion RMB (US\$6.8 trillion) urbanization plan on the ground. They must build hospitals and schools, provide public housing, construct airports and railroads, and absorb 100 million rural migrants into cities, while at the same time conserving precious land and water resources.

The government's new economic reforms pose new challenges to the country's limited water resources too. According to the reform plan, domestic consumption among the urban middle class is intended to slowly replace the export-oriented growth model. But satisfying a higher level of demand will invariably require more water.

What's more, under the Urbanization Plan, China's remote regions will be in competition with highly developed cities for limited water resources. Going forward, the government intends to purposefully guide the next wave of urbanization to “avoid the mistakes of the past.”² It is the existing cities that must be put under scrutiny, however, if history is not to be repeated.

Water is Running Out

The country's water challenge varies from region to region. While freshwater resources are concentrated in its southern and western regions, the reform and opening up of the 1980s resulted in the rapid development of urban clusters in the East and North, where water is far scarcer. Thus water use is uneven across the country: in the prosperous eastern regions, water consumption is high but efficient, while the less-developed western provinces tend to consume less water but waste much more.³ The most developed Chinese cities rely on groundwater, which is being overexploited by 22 billion cubic meters per year.⁴

China's agricultural needs also present an unsustainable drain on the country's water resources. Most of China's farmland is located in the arid North, necessitating creative distribution methods to ensure crops are irrigated. This situation has been devastating for what little water resources China has.

Unchecked development has reduced China's wetlands by 9% in little over a decade; lakes are shrinking, and rivers are drying up. Some cities have seen aquifer levels fall from 20-50 meters.⁵ Perhaps most egregious is the overall intensity of water use: China requires five times the amount to produce one unit of GDP than the global average.⁶

Water is Polluted

Rampant pollution is exacerbating the water shortage. In a 2014 report on 5000 monitored sites nationwide, the Ministry of Land and Resources condemned two-thirds of China's groundwater. The fact that the results were published at all is a hopeful sign, given that it has taken more than a decade for a National Groundwater Monitoring Project to be seen to fruition.⁷ Agricultural runoff contributes to more than half of China's water pollution, in large part as a result of excessive pesticide use.⁸ The remainder of the country's polluted water can be attributed to industrial discharge and municipal waste, which more than doubled between 2003 and 2010. Improper waste disposal abounds: the majority is either dumped directly into rivers or illegally injected underground.⁹ Only 23% of all industrial and urban sewage is treated according to national standards. The result: 65% of all urban drinking water sources are polluted.¹⁰

Climate change poses new challenges, as flash flooding leads to more water pollution, rising seawater leads to increased salinity of groundwater, and glacial retreat alters the rate of replenishment of rivers, among other things. Between 2000 and 2008, Asia experienced the greatest number of climate disasters worldwide.¹¹ The Intergovernmental Panel on Climate Change (IPCC)'s latest report states that climate change will compound the stresses caused by urbanization, development, and industrialization. China ranks among the top five countries threatened by flood risks; glacial retreat has been observed at the

source of one of China's most important rivers, the Yangtze;¹² and rising sea levels are contributing to ground sinking in cities like Shanghai, which are located in low-lying areas.

Heavy reliance on groundwater extraction in cities exacerbates this problem, making urban areas particularly vulnerable to climate risks.¹³ As flash floods erode soil, the built environment becomes even less equipped to handle stress. For example, in 2012, Beijing experienced record-breaking rainfall and flooding that destroyed hundreds of urban residences built as part of the late-wave urbanization drive on the outskirts. Rising sea levels, flooding, and changes in weather patterns, such as decreased precipitation, all threaten existing water management strategies, which in turn will hinder other aspects of the Urbanization Plan, such as achieving self-sufficiency in food production.

The IPCC's climate models predict China will not be able to meet demand for water by as soon as 2020s, as needs diversify with increased urbanization. While China's urban water consumption per capita has seen a slight decrease in the last ten years, owing to investment in municipal water systems, absolute water consumption continues to rise.

Rising Urban Demands

Urban lifestyles create demand for water in many indirect ways: as their discretionary incomes rise, Chinese urban residents choose to consume more meat and other water-intensive household products than those who live in the countryside.¹⁴ With the world's largest number of mouths to feed, food security has remained a crucial priority for the Chinese government for good reason.

The good news is that agriculture, which currently accounts for 63% of overall water use in the country, is the target of an industrial overhaul. In transitioning its rural population to urban centers, China plans to consolidate small-scale farmland into agri-businesses on par with developed nations.¹⁵ This may achieve some gains in efficiency (Chinese irrigation systems are notoriously wasteful). But these efficiencies may be superseded by the sheer scale of increased demand. Highly efficient industrialized farmland, with modern irrigation systems, will certainly help achieve the goal of reaching 95% self-sufficiency in food production. Centralizing the agricultural system will also reduce the amount of food wasted each year, increasing the productivity of each unit of water used.

Improving municipal water systems is equally imperative. Less than half of all urban water utilities operate at a profit, and only 60% of water is recycled throughout the country, while total wastewater generation has increased by 65% in a little over a decade.¹⁶ Volumes of municipal and household wastewater exceed those that are generated by industry, and this is only expected to rise alongside standards of living.^{17,18}

The Energy Challenge

While agriculture is currently the largest consumer of water, over the next 20 years, industrial water consumption is expected to comprise the largest growth¹⁹—especially in the construction and energy industries that will be needed to build and power China’s future cities.¹ **Electricity demand is expected to double by 2030, the majority of which is generated via water-intensive coal power plants.** Unfortunately, the central government’s attempts to control air pollution by diversifying power generation may further exacerbate the country’s water shortage. According to the Air Pollution Prevention Action Plan, coal’s proportion of power generation will be reduced while natural gas, nuclear, and hydropower energy usage will be increased. But as pointed out by the World Resources Institute, in many cases natural gas refers to the production of synthetic natural gas, a process that is even more water-intensive than coal.²⁰ Several synthetic natural gas plants have already been constructed in areas that are water-stressed.

Exploitation of the country’s shale gas reserves, which are the largest in the world, is another goal of the Air Pollution Action Plan. Unfortunately, the development of this industry would only put further strain on limited water resources. As some experts have pointed out, China simply does not have the water resources at its disposal to replicate the shale-gas boom of the United States.²¹

What Must Be Done

Addressing the water crisis in China will require a coordinated response across sectors, encompassing multiple industries. Many NGOs, including Thirst, advocate the combination of effective policies, the right incentives, the promotion of new technologies, and public education.

The central government has made strides with demand-side management, setting caps for water use by both industry and province. During periods of extreme water shortage, water-rationing policies have been successfully applied. However, these strategies must not be limited to emergency-response scenarios. They must be enacted broadly to ensure efficient water use at all times.

Efficiency: Safeguarding efficiency is one of the most crucial ways to improve China’s water situation today. As other regions prepare for urbanization, local governments should prioritize smart water use by upgrading their existing infrastructure and constructing sufficient water-recycling facilities.

Incentives: The correct market incentives will assist with enforcing these policies. Having generated income by penalizing the coal industry for air pollution, Beijing announced an updated

¹ The construction industry impacts water supply as well; in Xiamen, construction led to both water loss and soil erosion equal to 6.6% of the city’s total area¹.

tiered water-pricing scheme at the end of April 2014.²² Taken into effect almost immediately, the price increase affects only 10% of households (those who use over 190 cubic meters per year, or the equivalent of almost half a million water bottles). As 70% of Beijing residents believe that water waste is a serious problem, especially with regards to water-intensive facilities such as swimming pools, golf courses, and ski resorts. These businesses, which typically use between 190-260 cubic meters of water annually, will be charged 7 RMB/cubic meter; those using over 260 cubic meters will see the rate rise to 9 RMB.

Full-cost pricing: As the scheme will not directly impact most individual consumers, perhaps Beijing is hopeful that water-intensive businesses will actively try to reduce their water waste. Funds raised via the price increase will be allocated to water conservation projects and awareness raising activities. Despite this nominal increase, the average price of water in China will remain well under that of similar nations, such as Singapore, South Korea, and the United States. If Chinese residents are to recognize the true value of this precious commodity, the central government might seriously consider adopting a full-cost pricing mechanism for municipal water as a component of the Urbanization Plan.

Green bonds: The Urbanization Plan may also benefit from impending municipal finance reform. As the municipal bond market prepares to open, some think tanks have suggested the issuance of “green bonds” to upgrade infrastructure and ensure resilience in China’s new cities.²³ Responsible for many building retrofits in the United States, green bonds may provide another solution to financing badly needed improvements to water system management, and minimize water waste in the system.

Political incentives: Effecting change quickly requires that these policies be incentivized at the political level, as top-down management still reigns within the Chinese system. To this end, water resource management was recently included as an indicator in provincial government officials’ performance reviews.²⁴ Further incentives include the enforcement of stricter building codes, the championing of correct certifications, and the prospect of winning international recognition for adhering to globally accepted standards.

New technologies, not dangerous engineering projects: Technological advancements have the potential to bring China’s water resource management into the 21st century. While the government is already pursuing an engineering effort of an unprecedented scale to bring freshwater from the South to the North, the potential harmful impacts of the endeavor have raised criticism both domestically and internationally. Instead of costly diverting projects, the government should consider the immediate impact potential of water purification systems, improving grey-water use in cities, and water-smart urban planning for future cities. Both Beijing and Tianjin are experimenting with desalination.

Public pressure: The information age has vastly altered the Chinese government's willingness to respond to public concerns. A 2010 study in Beijing asked respondents to divulge their primary sources of learning about the water crisis: an overwhelming majority named news reports and media campaigns.²⁵ Facilitated by the social media campaigns connecting local environmental issues to national media outlets, there is a nascent acknowledgement social stability is linked to transparency. In January 2014, Minister of Environmental Protection Zhou Shengxian identified air, water, and soil quality as key priority areas for the coming year, in addition to promising an updated Clean Water Action Plan. At the time of this writing, the details of this plan have yet to be finalized, although 2 trillion RMB (\$330 billion USD) was earmarked for its purpose during the National People's Congress in March.^{26,27} The announcement pledged to reduce industrial discharge, improve urban sewage treatment, increase water conservation, and prevent water contamination.²⁸

Social media: With visible successes in facilitating dialogue between officials and the public, perhaps social media will play a role in the implementation and monitoring of water quality standards.

In this vein, Thirst has capitalized on the proliferation of social networking in China to promote water as an essential resource for human health, sustainable development, and biodiversity. In the above-mentioned study, when asked of the ways media might be harnessed for further public awareness, 52.1% responded, "give tips on water-saving through multi-channel promotion, so that the public can learn more about water-saving measures."

Education: Thirst's primary educational module, the We Water Experience, reaches 2000 students each month across China, the majority of which are located in tier-one cities. We emphasize our school outreach be complemented by multimedia activities²⁹, giving students something to share with their peers online. To target China's future leaders, we aim to make these educational modules a mandatory component of public curriculum. Thirst has found that young, urban, Chinese youth are receptive to being proactive about water conservation. They have pledged to take shorter showers, and to look out for leaky pipes in their communities. During Thirst's Water Dragon Educational Campaign, 88% of young participants said that they would change their purchasing habits to favor water-efficient products. Leaders in over 15 schools have created their own water-awareness clubs. On SinaWeibo, over 30,000 Thirst followers receive tips and suggestions for water conservation, and are linked to other important environmental stories around the country.

Conclusion

An urban middle class society may be relied upon to generate economic activity, but changing preferences will not be limited to consumption. Chinese society has become

increasingly agitated about the persistent reductions in air, soil, and water quality, demonstrated by the proliferation of environmental protests among middle class residents in the past few years. As China continues its march toward achieving a “moderately prosperous society,” total water consumption continues to rise while water quality has decreased.

It is promising that the government has, for the most part, adopted greater transparency in response to these complaints. Owing largely to the increased presence of online and social media, environmental awareness among urban Chinese is pushing the government to take action. The challenge will be to effectively harness the opportunities presented by urbanization: to upgrade faulty water infrastructure, improve water system management, recycle urban wastewater, reduce improper urban waste disposal, and conserve what limited resources remain. In order to ensure these steps are taken, the country must first encourage the necessary incentives to balance growth with sustainable development. Beginning with Chinese youth, education is the first step in changing attitudes about water – and an important step in addressing one of China’s most critical challenges.

Endnotes

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