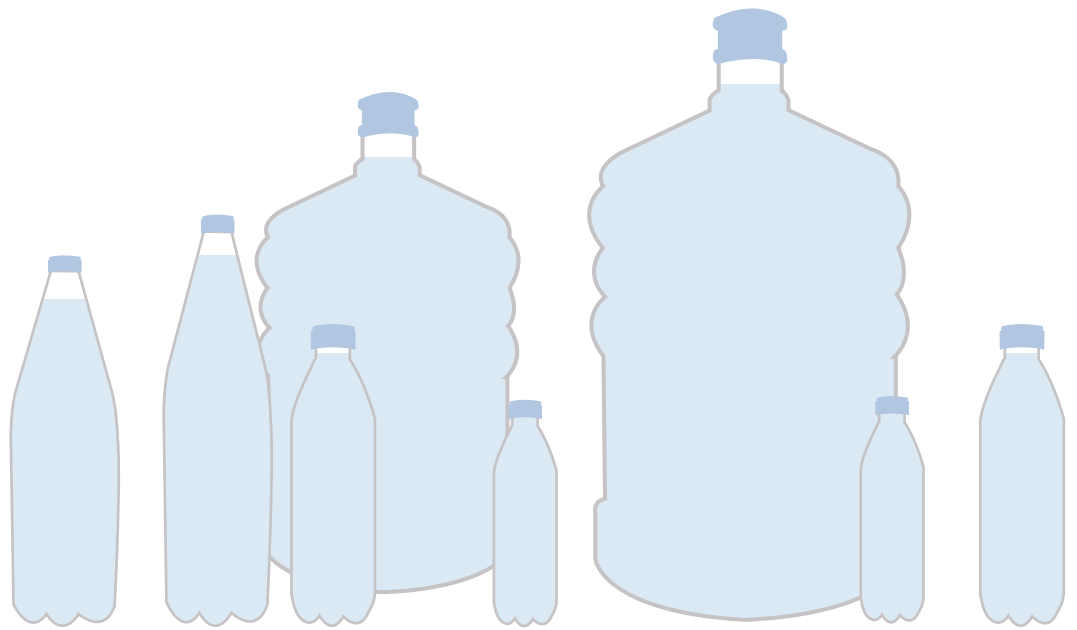


# 8



## THINGS YOU SHOULD KNOW ABOUT BOTTLED WATER IN CHINA



## 8 THINGS YOU SHOULD KNOW ABOUT BOTTLED WATER IN CHINA

### 1. Bottled doesn't necessarily mean better quality water

Bottled water is often assumed to be and advertised as clean, safe and healthy. But this may not necessarily be the case, as seen by some bottled water products failing to meet regular quality checks by the government. The National Food and Drug Administration's food safety inspection for the first quarter of 2015 revealed that 400 out of 407 beverage samples that failed to meet standards were bottled or carboy water. Over a dozen types of germs, mould, residual chlorine and other worrisome indicators were found.<sup>1</sup> This isn't a new trend. In 2012 quality checks in Hunan Province showed that 60% of sampled bottled water products failed to pass national standards and similar tests in Henan province reported 37.5%.<sup>2</sup>

Generally, consumers tend to trust big brand names but this too doesn't necessarily mean better quality. Robust, Wahaha, C'estbon and Nestlé (all renowned brands in China) have all previously featured in the 'blacklist' of non-quality compliant products. In September 2014 in Beijing, C'estbon's bottled water was found to contain bacteria 1,450 times of the allowed limit and Wahaha's product was found to contain over 8 times of the limit.<sup>3</sup>

In addition to quality there have been issues with the validity of labelling. Some bottled water labelled as "mineral water" has been found to not actually contain the relevant minerals and failed to pass tests of relevant physical indicators<sup>4</sup>, so in fact is not mineral water.

Moreover, consumers often find it difficult to decipher between 'natural mineral water', 'spring water' and 'mineralized water', and get confused by new products

such as 'oxygen rich water' from Wahaha or 'water for babies' from Nongfu Spring. The new 'Food Safety National Standard on Packaged Drinking Water' (GB 19298-2014) implemented on 24 May 2015 aims to address this labelling issue. This means that bottlers can no longer freely name products and can only choose from one of the following two categories - 'purified water' or 'other water'. This is expected to be enforced from 1 January, 2016. The standard also sets limits on physicochemical and microbiological indicators. Mineral water has a separate standard. *More in Chapter 2: "No Water, No Bottled Water Market - New Standards: No More Muddy Water"*.

### 2. Bottling factories are not properly regulated leaving you exposed

The boom of bottled water in China has resulted in the emergence of 'fake water'. 'Fake water' refers to bottled water or carboy water produced by unauthorized or unregulated companies that source water from illegal wells or use tap water without proper treatment. 'Fake water' often poses health risks, as the water is not sufficiently treated.

Moreover, those companies often reuse old carboys or use poor quality carboy containers. Shockingly, 'Beijing Evening News' reported that out of 650,000 carboys of water consumed every day, 100,000 were produced by unauthorized small factories. These 100,000 were often sold with fake labels of big brands.<sup>5</sup>

However, even for regulated beverage companies there is no obligation to reveal detailed information of their water sources. It is also not mandatory to publish results from



factory tests. This leads to information asymmetry, where consumers believe that bottled water is clean but really it could just be from the tap. Further health risks can come from the insufficient removal of chemicals from the water source, such as environmental hormones, antibiotics and other drug remnants (studies show to be coursing through China's waterways). *More on what the government has been and is doing to safeguard drinking water quality and supply in Chapter 2: "No Water, No Bottled Water Market – Regulatory Risks".*

Furthermore, those illegal bottlers tend to use poor quality recycled plastic containers (bottle or carboy) which may not meet the grade of food and safety standards. Drinking water from such containers could pose health risks.

### 3. Bottled water is very expensive compared to tap water

Assuming an average person drinks 2 litres/day and if all the water drunk came from carboys then your annual spending would be at least RMB800 or RMB1,500 for bottled water.<sup>6</sup> Thus for a typical family (3 members), the cost of drinking water would range from RMB2,400 to RMB4,500 per year. However, if you purchase premium bottled water which sources water from glaciers or volcanic springs, the cost could be 5-10 times more.

In comparison, according to the National Bureau of Statistics, the average income per capita for urban residents in China as of the first half of 2015 is only RMB10,931. This means you are spending around 7% or 14% of your income on carboy or bottled water respectively; let alone the premium for bottled water.

What if you drank from the tap? In Beijing, this would be around RMB3.5 per person per year. In other words, practically nothing compared to bottled water. Why would

you spend thousands of yuan on something that you could get almost for free? And why spend money when there is no guarantee of quality or that you're not actually drinking tap water?

Although in some cities the current quality of tap water is not fully secured, there may be some options in between that are less expensive: such as a household water filtration system or carrying a water bottle so that you could fill water from public water filling stations? By doing this, you will not only save money, but also reduce the large water, energy and plastics footprints associated with producing bottled water.

### 4. One bottle of bottled water = up to almost three additional bottles of water + ¼ bottle of oil

Behind the façade of cleanliness, purity and nature, comes the heavy burden of bottled water with high water and carbon footprints. Though researchers around the world differ on the footprint intensities, one clear message is that bottled water comes at a high cost and not just in dollars.

The International Bottled Water Association (IBWA) provides a low estimate based on data from its seven North American members and one industry peer: to produce one litre of bottled water, it would require an average of only 0.32 litres of extra water - that means in total 1.32 litres of water. However, this only considers "water used by the facility, including product water, and water used for facility processes (e.g. treatment, cleaning & maintenance)".

The National Development and Reform Commission (NDRC) of China also provides industry benchmarks of total water withdrawal for bottled water production in its 'Norm of Water Intake for Beverage Manufacture' (QB/T 2931-2008), which has been in force since 1 July 2008.



Subject to the type of packaged water, level of production and recycling of plastic containers, the overall range can be around 1.6 – 3.74 m<sup>3</sup>/t. For energy consumption, Ministry of Industry and Information Technology (MIIT) standard 'Norm of comprehensive energy consumption for beverage manufacture' (QB/T 4069-2010), which came into force on 1 March 2011, gives a range from 0.002-0.018 kg standard coal equivalent per 1 litre of bottled water. This is equivalent to 0.01-0.15kWh of electricity.<sup>7</sup> The range has taken into account multiple facts which are based on whether the plastic bottles are produced by the bottlers and whether there is a recycling scheme. However, the values only include the energy consumption during the manufacturing of bottled water.

The Pacific Institute's study estimated that, for every bottle of water produced, twice as much extra water is used in the production process. This means, producing 1 litre of bottled water, requires in total 3 litres of water. In addition, the energy requirement for producing one bottle is up to a quarter of the bottle filled with crude oil equivalent. More specifically, according to Gleick and Cooley (2009)<sup>8</sup>, producing one litre of bottled water requires 5.6-10.2 MJ of energy. This is equivalent to 1.56-2.83 kWh of electricity.<sup>9</sup> Transportation and plastic manufacturing account for a total 96% of energy consumption with the remaining 4% from water treatment, bottling and cooling.

Therefore, for water consumption, we use NDRC's benchmark; while, for energy consumption, to get a fuller picture, we opt for the research done by Peter Gleick from the Pacific Institute.

## 5. Water use by the bottled water industry can fill more than 20 west lakes

We looked up the company websites of some household bottled water brands including Wahaha, Nongfu Spring, Master Kong, Uni-President, Evergrande, Robust and Nestlé. Unfortunately, no water use data is disclosed by any of these companies. Moreover, there is also no research, at least that we can find, on this topic. In 2012 China produced in total 55.6 million m<sup>3</sup> of packaged water. Based on the IBWA benchmark, 73 million m<sup>3</sup><sup>10</sup> of water was used to produce this, whereas the Pacific Institute's benchmark gives us an estimate of 167 million m<sup>3</sup> of water.<sup>11</sup> If we use the estimate from the NDRC norm (i.e. 1.6-3.74 m<sup>3</sup>/t), in 2012, China's packaged water industry could have used in total 89 - 208 million m<sup>3</sup> of water in production. The volume of the famous West Lake is about 10.2 million m<sup>3</sup>, which means that the water used in packaged water production in 2012 could fill up over 20 West Lakes.

Assuming urban residents use about 2%<sup>12</sup> of supplied water for drinking and cooking, then the amount of tap water used for drinking and cooking in 2012 would be around 316 million m<sup>3</sup>.<sup>13</sup> In other words, the water used by the bottled water industry based on the estimate from the NDRC's norm (i.e. 89-208 million m<sup>3</sup>) would be 28% to 66% of the amount of tap water used for drinking and cooking.

As stated previously, it is not mandatory for beverage companies to disclose their water sources or their water use. Without such information, it is difficult to know how much water is being withdrawn and from what source. During the 12<sup>th</sup> Five Year Plan (12FYP) (2011-2015), the government is expected to spend RMB700 billion to protect freshwater supplies from source-to-tap, improve and upgrade water supply networks and raise tap water quality. With such huge government investment, would it



be fair for some bottled water companies to bottle from the tap and then sell to the public at a much higher price than tap water? *More in Chapter 1: “Can China afford the luxury to grow 8.5x? Total water use can be up to 1.8 billion m<sup>3</sup>”.*

## 6. Bottled water industry energy consumption = annual electricity generated by the Three Gorges Dam

Compared to water consumption, energy consumption is often neglected. However, the production of plastics, withdrawing water from the source, processing, bottling, packaging, sealing, transportation and cooling all require energy.

Based on the Pacific Institute’s study, we calculated the energy consumption (entire life cycle from production, transportation to cold storage) of the Chinese bottled water industry in 2012 to be 87-158TWh of electricity. This is equivalent to 88% to 161% of the total electricity generated by the Three Gorges Dam in 2012 (98.1TWh<sup>14</sup>). This was about 0.3% - 0.5% of China’s primary energy consumption in 2012.<sup>15</sup> This is comparable to the US: Gleick and Cooley (2009) estimated that the energy input required for the bottled water production in 2007 was equivalent to a third of a percent of total US primary energy consumption.

These amounts are significant. For example, China has an energy savings target of 702TWh of electricity by 2020.<sup>16</sup> If China was to improve public water supply and make tap water fit for drinking, the demand for bottled water might fall. Assuming no more bottled water would be produced, 12% - 22% of the energy saving target could be achieved. Note here that this is based on the latest available official packaged water production data in 2012; the 2014 share could be much larger.

Bottled water’s energy consumption also has other environmental impacts. Of all the processes in bottled water’s production and supply chain, transportation is one of the most energy intensive. This is because the main fuel for bottled water transportation (either by land or by sea) is fossil fuel – a major source of air pollution. China’s Ministry of Environmental Protection (MEP) has confirmed vehicle exhaust as the primary source for high levels of atmospheric particulate matters (i.e. PM2.5) in cities like Beijing, Guangzhou and Shenzhen.<sup>17</sup>

If the bottled water market continues to expand, the associated energy consumption will also increase. See *more in Chapter 1: “Kaching \$\$\$! China’s bottled water market can be 8.5x larger” in the report.*

## 7. Bottled water industry uses one Jinmao Tower of plastics a year

According to the Pacific Institute, producing one tonne of bottled water would require about 28.8 kg of plastics, mostly Polyethylene terephthalate (PET).<sup>18</sup> Similarly, as told by a Jilin Development and Reform Commission official, to produce 1 tonne of bottled water packaged in 660 mL bottles, around 28.5 kg of PET or Polypropylene (PP) plastic is needed - only for the body of the bottle, not including labels or the bottle cap.

Due to the lack of information, actual plastic consumption for bottled water is unknown. We did a rough estimation based on these two estimates, which resulted in about 1.6 million tonnes of plastics required to produce bottled water in 2012. In short, approximately 1.6 million tonnes of plastic materials (if not recycled) ended up as waste in 2012. All this plastic waste could almost fill up the famous Jinmao Tower (420m tall) in Shanghai.



The question is then, how much of that 1.6 million tonnes of plastics was recycled or reused? It remains unknown as there is no such data available. We only know that as little as 23% of all plastics was recycled in 2013, according to National Development and Reform Commission (NDRC) statistics. In China, there is a common misconception that plastic bottles are not wasted because scavengers collect them and sell them for money. However, this is not always true. Bottles are still flowing to landfills or incineration plants. In fact, according to NDRC's statistics, China's recycling rate has been decreasing over the last five years<sup>19</sup>, most likely due to the falling oil price, which reduces the incentive to recycle plastic waste.

The reality is that many bottles, although labelled as "recyclable", end up in landfills or waste incineration plants, and some unfortunately in forests, farmlands, rivers, lakes and the sea. Even for those bottles that are picked up by scavengers, many likely go to small illegal recycling factories that do not necessarily meet industrial standards, which then raises even more pollution issues.

So, when you next think about buying a bottle of water think twice. Where do you want that bottle to end up? See more in Chapter 1: ***"It's not just concern over quality, convenience matters"*** in the report.

#### **WARNING! – WATER, ENERGY & PLASTIC CONSUMPTION UNDERESTIMATED**

The 55.6 million m<sup>3</sup> of packaged water production in 2012 was only from 506 packaged water companies included the statistical yearbook. However, there are up to 12,000 facilities in China with valid licences to produce packaged water. So the actual production could be greater. Of the up to 12,000 packaged water facilities, not everyone has adopted advanced technologies. In fact, many of them are small and medium sized companies located in county level cities, so it is likely overambitious to apply the same benchmarks as the US. Therefore, the real figures of water, energy and plastic consumption could be much higher than our estimates.

If China's bottled water market was to continue its rapid development and reach the level of Brazil, China would need three times the amount of current water use, and to reach Mexico, eight and a half times. Even if bottled water companies improved their water and energy management, it's clear that water and energy consumption by the industry is going to go up. What would this mean for China's limited water resources and its path towards a water and energy secure future.



## 8. Bottled water threatens China's groundwater and Asia's glacial watersheds

China's groundwater, glaciers, rivers and watersheds are all under threat. In the meantime, China's bottled water market continues to grow and companies make more and more money. The industry has invaded national nature conservation zones<sup>20</sup> and national forest parks<sup>21</sup> including the Changbaishan region (the Ever White Mountains) in Jilin province, and in Xinjiang, luxury bottled water brand "Pamir" is bottling water from Muztag Ata (the second highest of the mountains which form the northern edge of the Tibetan Plateau).<sup>22</sup>

Such commercial activities also impact local communities. Residents living near the source of water bottled brand "Yunnan Spring" have complained that lakes and wells are drying up and that they have to look for alternate drinking water sources, according to Globalization Monitor.<sup>23</sup>

Is it ethical to prosper by taking water from the headwaters of Asia's waterways which feed downstream countries including India, Bangladesh, Myanmar, Laos, Thailand, Cambodia and Vietnam? With glaciers in the Qinghai-Tibetan Plateau shrinking 15% over the last three decades,<sup>24</sup> the stakes are high. Development surrounding the glacier areas will have regional watershed implications and global climate ramifications. As the upstream riparian, China no doubt needs to play a central role to ensure regional water security.

Hopefully these 8 reasons have made you think twice about your next bottle of water.

See *Chapter 4: "In Need of a Bottled Water Revolution"* in the report for our views on this and how high the stakes really are.

# 8

# THINGS YOU SHOULD KNOW ABOUT BOTTLED WATER IN CHINA

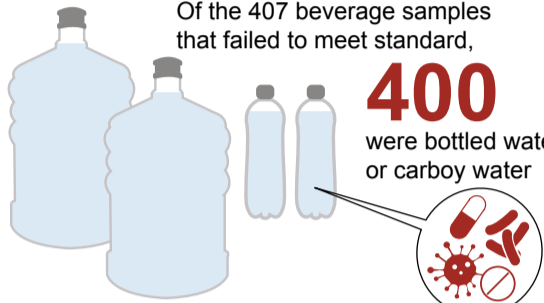
1

## Questionable Quality

Of the 407 beverage samples that failed to meet standard,

**400**

were bottled water or carboy water



Bottled water can contain environmental hormones, antibiotics, other drug remnants & bacteria

2

## Not Regulated



**1 in 6** carboys consumed daily have fake labels

No obligation to reveal detailed information of their water sources or results from factory quality tests

Labelling of packaged drinking water as "purified water" or "other water" only required from 1 Jan 2016

4

## Resource Intensive to Produce

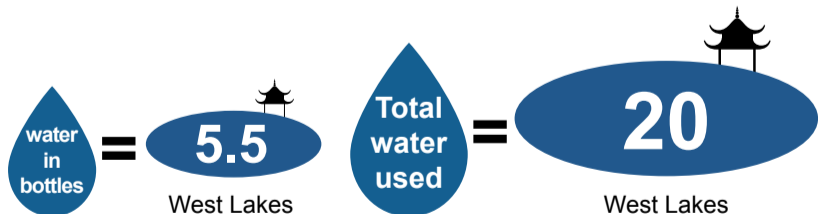
Production of 1 bottle of water



**1** bottle of water = **3.74** bottles of water + **1/4** bottle of oil

5

## Water Use

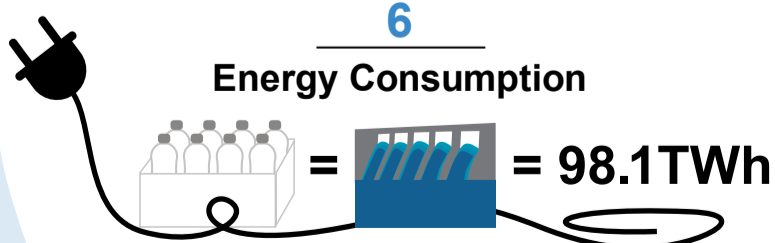


Water packaged in 2012 can fill 5.5 West Lakes

Total water used in production can fill 20 West Lakes

6

## Energy Consumption



Energy used in packaged water production in 2012 is comparable to the annual electricity generated by the Three Gorges Dam at 98.1TWh

3

## More Expensive



**RMB1,500/year**

Average bottled water cost per person



**RMB3.5/year**

Average tap water cost per person

7

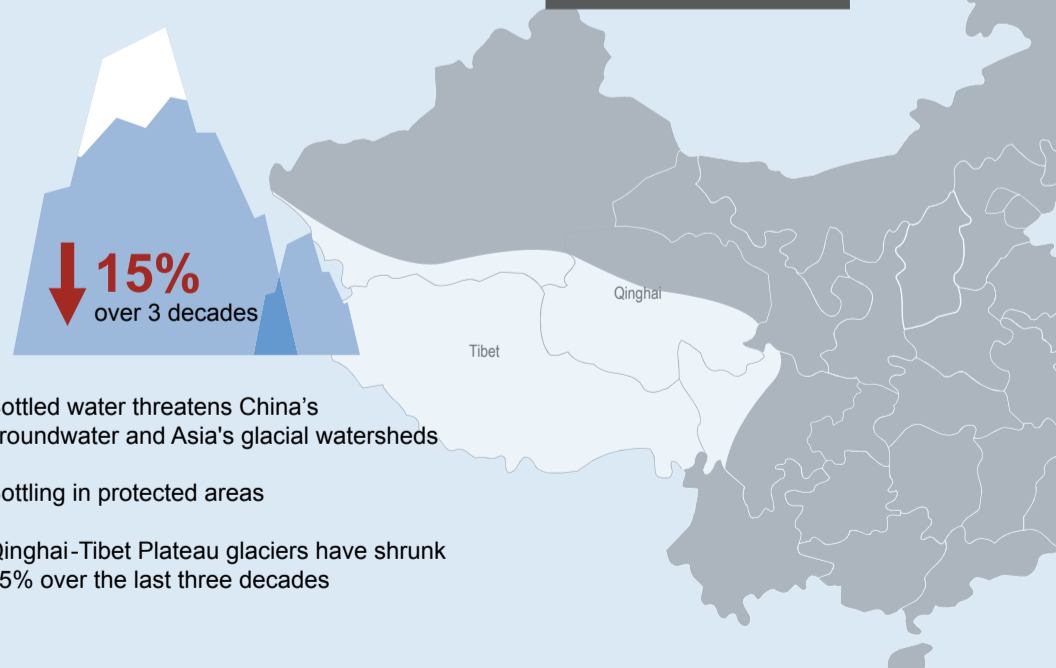
## Plastic Usage

**Almost 1 Jinmao Tower**

Plastic used in packaging is enough to fill up almost 1 Jinmao Tower

8

## Threatens Water Resources & Environment

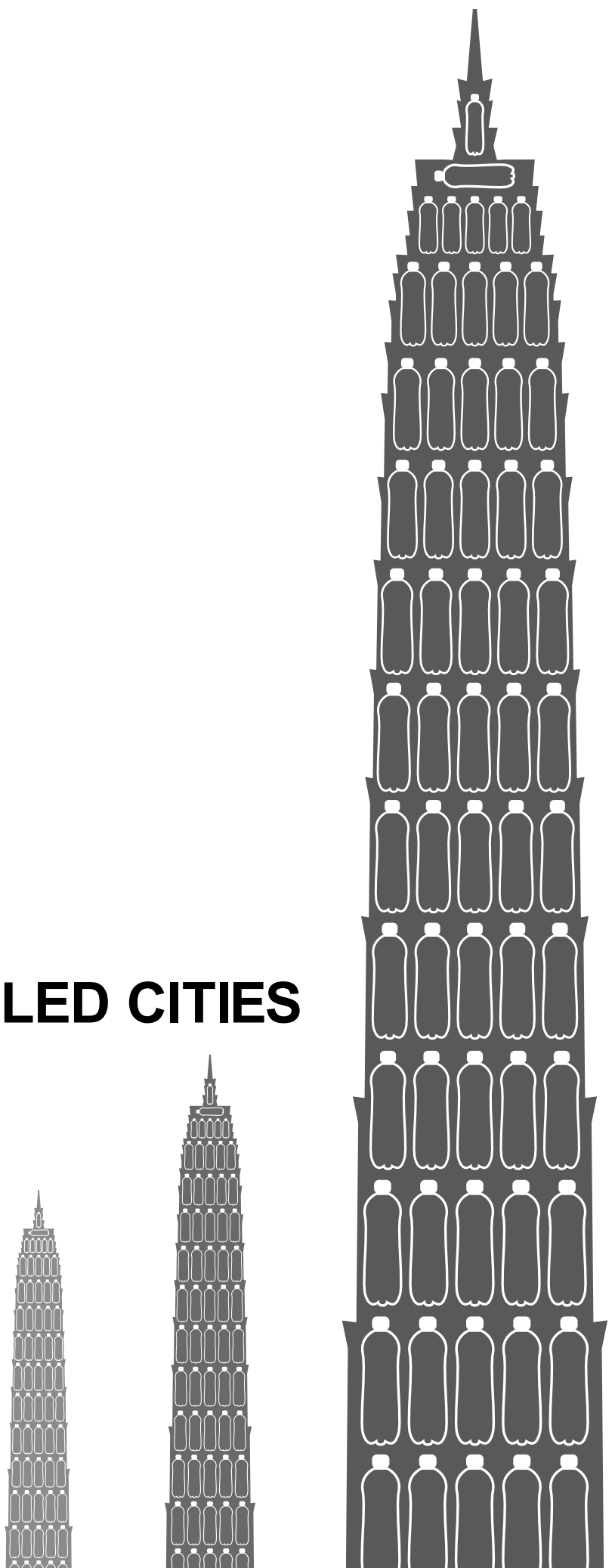


- ⚠ Bottled water threatens China's groundwater and Asia's glacial watersheds
- ⚠ Bottling in protected areas
- ⚠ Qinghai-Tibet Plateau glaciers have shrunk 15% over the last three decades

Sources: The First Food Safety Survey Results of 2015 (2015年第一期食品安全监督抽检信息), SFDA, 2015; 'Food Safety National Standard on Packaged Drinking Water' (GB 19298-2014); '40% of Beijing carboy water stations operate illegally' (北京桶装水站被曝四成不正规 每日10万桶假水被消费), Beijing Evening News, 8 April 2015; calculated based on the sale price of Nestle packaged water products. RMB23 for 18.9L carboy purified water - [http://www.nestle-waters.cn/product/North\\_product02.aspx](http://www.nestle-waters.cn/product/North_product02.aspx), NDRC benchmark: 'Norm of Water Intake for Beverage Manufacture' (QB/T 2931-2008); Pacific Institute & Gleick, P. H. and Cooley H. S. 2009 - Energy implications of bottled water. Environ. Res. Lett. 4 (2009) 014009, China Water Risk 2012 estimates based on: previously cited NDRC and Pacific Institute benchmarks, [http://www.gov.cn/jrzq/2013-01/08/content\\_2307651.htm](http://www.gov.cn/jrzq/2013-01/08/content_2307651.htm), Pacific Institute - Bottled Water and Energy Fact Sheet - February 2007, and the internal volume of the Jinmao Tower (420m) in Shanghai is roughly 1.19 million m<sup>3</sup> based on various news sources; Jilin Development and Reform Commission official. According to the official website, 'Nongfu Spring Premium Water source, named Moya Spring, located in the Lushuihe National Forest Park'; See 'the introduction of water source' at <http://www.cnpamirs.com/ch/info.php?id=1&zid=2&en=c>; 'Qinghai - Tibet Plateau glaciers shrink 15% in 30 years', Xinhua News English, 22 May 2014



# THE RISE OF PLASTIC WALLED CITIES





## THE RISE OF PLASTIC WALLED CITIES

For the consumer, the life of a bottle of water ends once the water inside has been consumed, leaving an empty plastic shell that is considered waste. Such waste has been a significant contributor to the phenomenon known as “waste walled cities” in China, which refers to cities surrounded by waste. But it’s not just the end of a bottle’s life that is an environmental issue, but also its birth. The production of a plastic bottle requires energy, usually in the form of petroleum chemicals. The costs from plastic water bottles are clearly being felt in China.

### Unregulated & ineffective plastic recycling in China

As we estimated in “*8 Things You Should Know About Bottled Water in China*”, in 2012, producing bottled water in China would have used about 1.6 million tonnes of plastics. The question is then, how much of that 1.6 million was recycled? Again, no such data is available. Experts from the recycling industry and environment NGOs like the Nature University told us that for the most optimistic estimation, up to 90% of plastic bottles are recycled. This is much higher than China’s recycling rate of all plastic waste in 2013, which was only 23%, according to NDRC statistics.<sup>25</sup>

Many recycled plastics do not meet the grade of food and safety standards. Some NGOs have previously reported small plastic recycling factories in coastal areas that have caused serious water and air pollution



Of the 90% of plastic bottles recycled the portion sent to regulate recycling channels is unknown. Regardless, due to limits on financing and technologies, many recycled plastics do not meet the grade of food and safety

standards. Therefore, the recycled plastic can usually only be used by textiles and other industrial markets. As for the illegally recycled plastics, the situation is likely worse. Some NGOs have previously reported small plastic recycling factories in coastal areas that have caused serious water and air pollution.

### Dumping of plastic water bottles is exacerbating China’s “Waste Walled Cities” & damaging ecosystems

For the plastic water bottles that are not recycled, they usually end up in landfills or being incinerated, or illegally dumped into waterways or environmental areas and end up as permanent (long-term) solid waste. It is this dumping in landfills that has grown this “waste walled cities”. In some cities, poor landfill management threatens soil and groundwater safety, with pollutants and chemicals leaching from the waste. As for waste incineration, there has been much public opposition, known as the “Not-In-My-Back-Yard” (NIMBY) movement.

The waste issue is not restricted to land, and has also become an issue for seas. An “island” of more than 400 million tonnes of plastic waste (2 times of the size of Texas) has been discovered between Hawaii and the west coast of the US; it is killing aquatic life and birds in the area. The United Nations Environment Programme (UNEP) has predicted that the cost of this damage to the oceanic ecosystem exceeds USD13 billion per annum.<sup>26</sup>



An “island” of more than 400 million tonnes of plastic waste (2 times of the size of Texas) has been discovered between Hawaii and the west coast of the US



China's issues with plastics are much more complicated than Europe or America's. On one hand, China has never been able to establish an official and effective waste recycling system and on the other hand, not many brands in China are practicing the "extended producer responsibility".<sup>27</sup> International brands like Nestlé are also lacking in this regard in China; they have plastic recycling and reduction practices in Europe and the US but not in China.

**! China's issues with plastics are much more complicated than Europe or America's**

### **Glass bottles worse than plastic**

Glass recycling is being done by some Chinese brands including Nongfu Spring and Laoshan Mineral Water. Glass bottles are to target high-end consumers. The CEO of Nongfu Spring, Zhong Shanshan, commented during a media interview, "*On the negotiation table of the Premier, there should be glass bottled water.*"<sup>28</sup> However, under China's current recycling system, glass bottles are even worse than plastic bottles. This is because individual waste collectors and recycling dealers do not recycle glass bottles. This is due to the lack of incentives. Moreover, there is also no deposit system or recycling system from the bottled water companies. Thus, consumers have no choice but simply throw away the glass bottle. In addition, the extra fragility and weight compared to plastic bottles mean transportation demands are greater.

**! No deposit system or recycling system from the bottled water companies. Thus, consumers have no choice but simply throw away the glass bottle**

### **A plastic future ever after for China?**

Unfortunately, not all consumers understand the correlation between their consumption and the "waste walled cities", or the floating "plastic island" between Hawaii and the west coast of the US. According Civic Exchange (a think tank based in Hong Kong), over 80% of the respondents in a survey they conducted believe that plastic waste is a serious issue, however only 15% expressed a great deal of personal concern about it. In other words, in their survey, caring about plastic waste had no clear relationship with whether or not respondents drank bottled water.<sup>29</sup> This attitude means that most consumers will continue their current purchasing behaviour of bottled water.<sup>30</sup>

Chan Li Wen, waste management researcher of the NGO Nature's University, is concerned with China's plastic issue. This is compounded by the dropping price of oil, which is resulting in significantly fewer recycling benefits and thus impetus for scavengers, corporates or people to recycle. Additionally, both the government and corporates have no effective policies to promote plastic waste or waste recycling. This could lead to more PET materials being produced from petrochemicals to satisfy the demand for bottled water and concurrently fewer and fewer plastics are being recycled back into the system.

**! Both the government and corporates have no effective policies to promote plastic waste or waste recycling**

As long as the bottled water industry grows, consumers don't change their consumption behaviours and the government and companies don't implement recycling policies, China's plastic challenge will continue to grow along with water scarcity.



## ABBREVIATIONS

12 <sup>th</sup> FYP	12 Five Year Plan (2011-2015)
13 <sup>th</sup> FYP	13 Five Year Plan (2016-2020)
CPC	National People's Congress
CPPCC	Chinese People's Political Consultative Conference
FMCG	Fast Moving Consumer Goods
IBWA	International Bottled Water Association
MEP	Ministry of Environmental Protection
MIIT	Ministry of Industry and Information Technology
MLR	Ministry of Land and Resources
MOHURD	Ministry of Housing and Urban-Rural Development
MWR	Ministry of Water Resources
NDRC	National Development and Reform Commission
NIMBY	"Not-In-My-Back-Yard" movement
PET	Polyethylene terephthalate
PP	Polypropylene
SFDA	State Food and Drug Administration
SNWDP	South-to-North Water Diversion Project
SOE	State-owned enterprise
UNEP	United Nations Environment Programme



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4. 'The First Food Safety Survey Results of 2015(2015年第一期食品安全监督抽检信息)', SFDA , February 2015
5. '40% of Beijing carboy water stations operate illegally – 100,000 carboys of “fake water” being consumed daily' (北京桶装水站被曝四成不正规 每日10万桶假水被消费), Beijing Evening News, 8 April 2015
6. We use Nestlé's retail price for reference. Nestlé 5 gallon (18.93 litres) carboy water is priced at RMB23 on its website. Smaller packaged water, in bottles, is sold at a range of RMB2-4 depending on the package
7. 1kg standard coal equivalent =8.1367kWh
8. Gleick, P. H. and Cooley, H. S. 2009. Energy implications of bottled water. Environ. Res. Lett. 4 (2009)014009
9. 1kWh = 3.6 MJ
10. 55.6 million tonnes x (1 + 0.32) = 73 million tonnes
11. 55.6 million tonnes x 3 = 167 million tonnes
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14. Chinese government news, 8 January 2013, [http://www.gov.cn/jrzq/2013-01/08/content\\_2307651.htm](http://www.gov.cn/jrzq/2013-01/08/content_2307651.htm)
15. In 2012, China's primary energy consumption was 3.62 billion tonnes of standard coal equivalent, which is equivalent to about 29,470TWh.
16. 'China's National Plan on Climate Change (2014-2020)( 国家应对气候变化规划(2014-2020 年))', NDRC, 19 September 2014
17. 'MEP: Cars are the primary pollution source in Beijing, Hangzhou, Guangzhou & Shenzhen (环保部: 北京杭州广州深圳首要污染源是机动车)', Xinhua News, 1 April 2015
18. Pacific Institute, Bottled Water and Energy Fact Sheet, February 2007. "...Americans bought a total of 31.2 billion liters of water in 2006.... requiring nearly 900,000 tons of the plastic." Thus, producing one tonne of bottled water requires 900,000/(31.2\*1,000)=28.8kg of plastics. The amount did not include the plastic usage of caps and had considered the efforts on lighter bottles
19. 'Annual Report of Comprehensive Utilization of Resources 2014(中国资源综合利用年度报告)', NDRC, October 2014
20. According to the longitude and latitude disclosed in 'Changbaishan Regional Mineral Water Resources Conservation and Development Plan (长白山区域矿泉水资源保护与开发利用规划)' issued by Jilin Provincial Government, at least two springs planned to be developed by 2015 – "Changbaishan Ice Spring (长白山冰泉)" and "Changbaishan Ice Spring No.1 (长白山冰泉1号)" - are located in the core area of Changbaishan National Nature Conservation Zone
21. According to the official website, "Nongfu Spring Premium Water source, named Moya Spring, locates in the Lushuihe National Forest Park"
22. See 'the introduction of water source' at <http://www.cnpamirs.com/ch/info.php?id=1&zid=2&en=c>
23. 'Truth Behind Bottled Water: Why bottled water is NOT the solution for China's drinking water crisis', Globalization Monitor, March 2014
24. 'Qinghai-Tibet Plateau glaciers shrink 15% in 30 years', Xinhua News English, 22 May 2014
25. 'Annual Report of Comprehensive Utilization of Resources 2014(中国资源综合利用年度报告)', NDRC, October 2014
26. '2014 Annual Report', UNEP
27. "Extended Producer Responsibility" refers to that, producers should not only take responsibility during manufacturing process, but also the whole life circle of the product, especially when disposal and recycled
28. 'Zhong Shanshan, CEO of Nongfu Spring: Premier shall have glass bottled water on the negotiation table' (农夫山泉董事长钟睺眙: 总理谈判桌上应放玻璃瓶水), Sina Finance News, 1 February 2015
29. 'Reducing Plastic Waste in Hong Kong: Public opinion Survey of Bottled Water Consumption and Attitudes Towards Plastic Waste', Civic Exchange, April 2015
30. 'Reducing Plastic Waste in Hong Kong: Public opinion Survey of Bottled Water Consumption and Attitudes Towards Plastic Waste', Civic Exchange, April 2015



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