Securing Water for All

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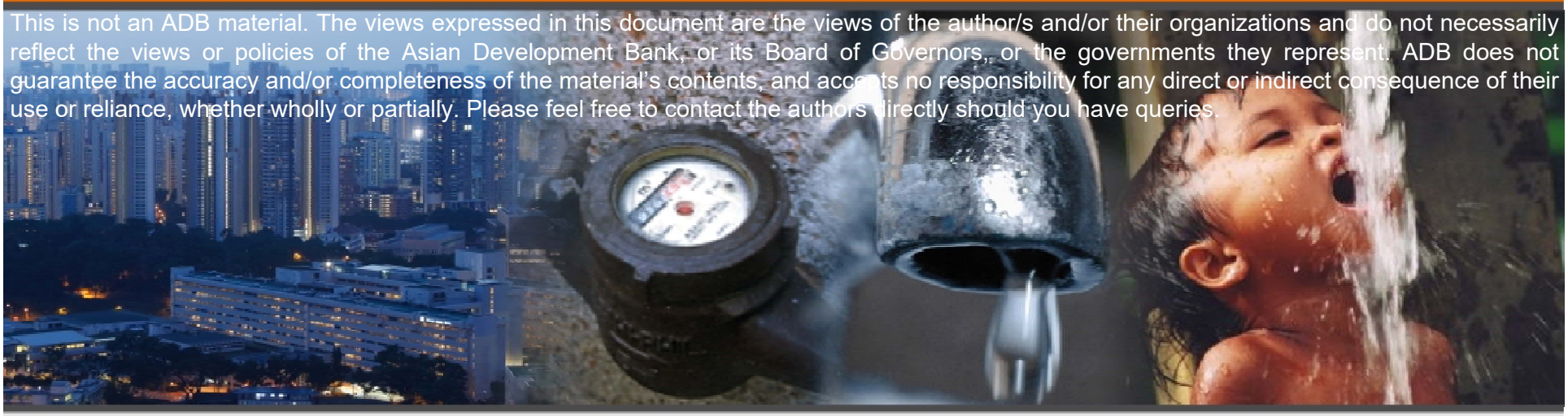

Policies Posed to Support Urban Water Reuse, a Chinese Perspective

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Outline

1. Background
2. Development of wastewater treatment in P.R.C
3. Reclaimed water usage in P.R.C: current status
4. Reclaimed water in Beijing
5. Ambitions and strategic measures

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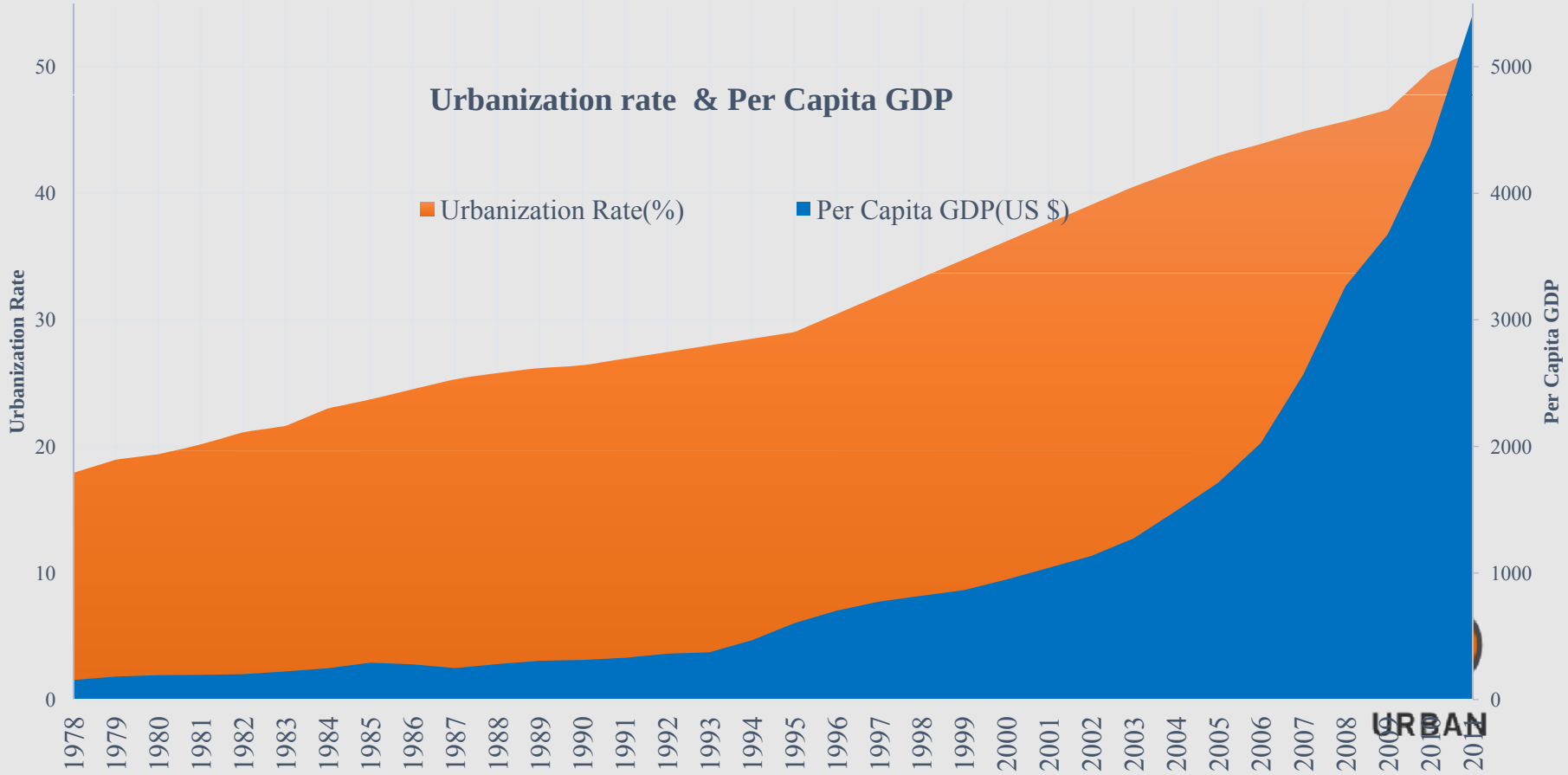
1. Background

(1) About China: Rapid growth in the past 3 decades

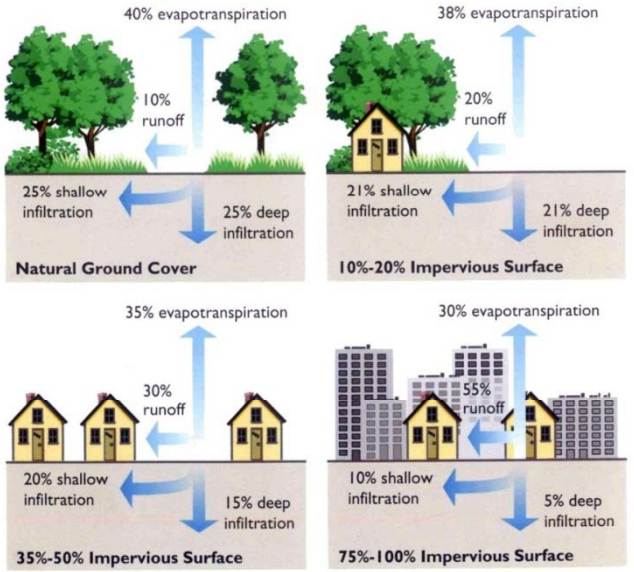
- Population: 1.35 billion (2011)
- Total GDP : 8.30 trillion US Dollar ， average annual growth rate: 10%
- Urbanization rate: 51.27% (2011), average annual growth rate: 1%, about 13.5 million people move to cities



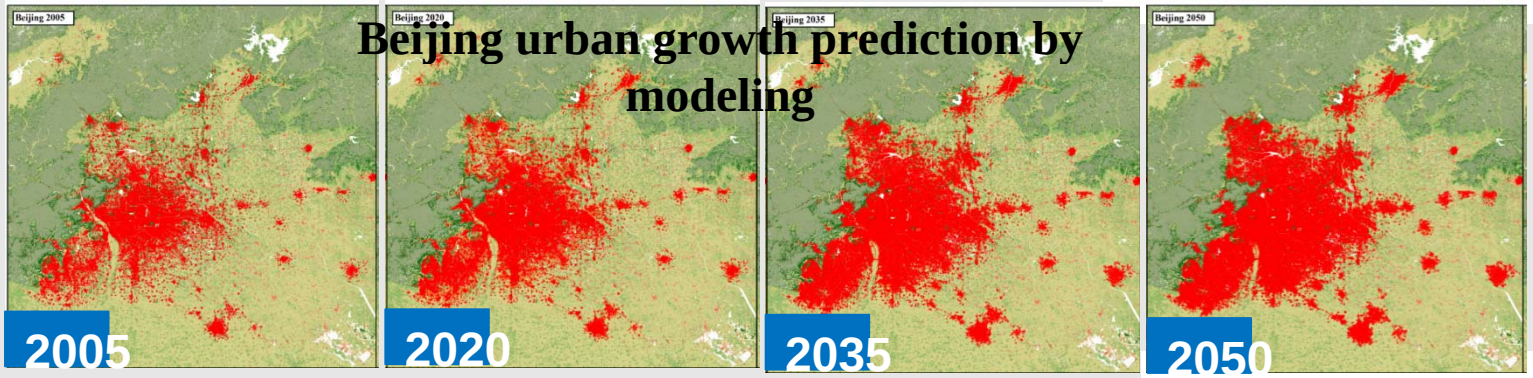
1. Background

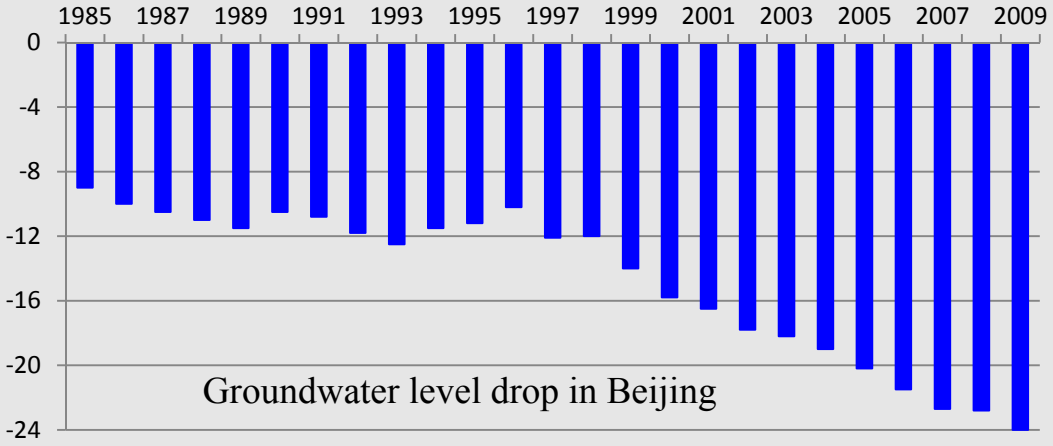
Rapid urbanization has great impact on urban water

- Freshwater demand: more severe water shortage crises and groundwater depletion;
- More impervious land: urban flooding;
- More wastewater produced: water pollution

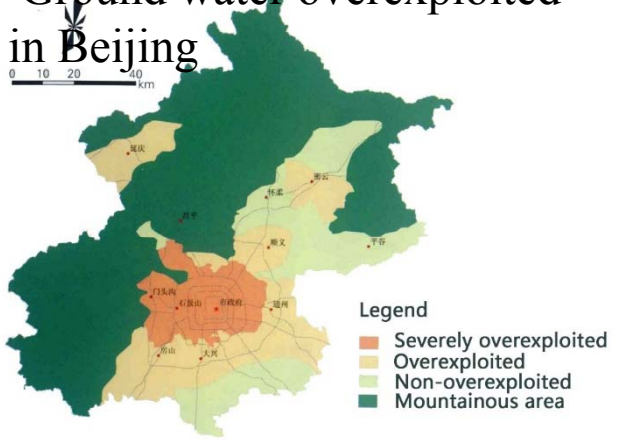


Beijing urban growth prediction by modeling





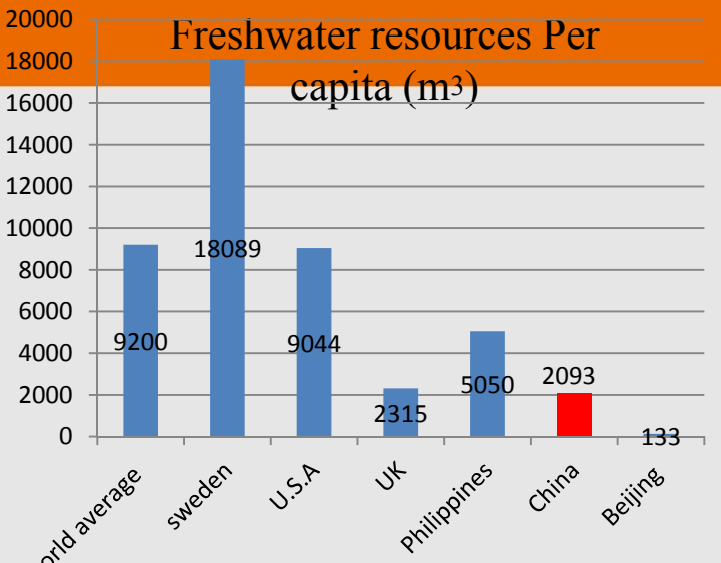
Ground water overexploited in Beijing



1. Background

(2) Water resources shortage: a key constrain for China

- Total freshwater resources: 2.8 trillion m^3 (ranking 5th in the word)
- Freshwater resources per capita: less than 2100 m^3 (ranking 100th in the word)

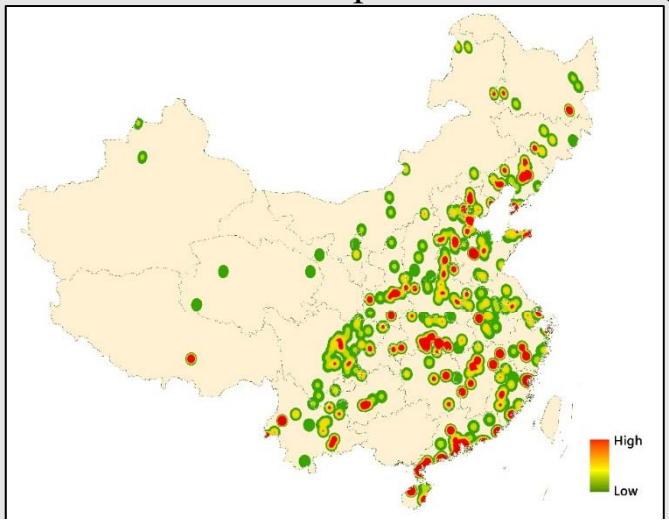


Data Source: The World Bank indicator 2011 and Beijing water resource bulletin 2011

(3) Resources & environmental pressure: increasing significantly

- Water pollution: not been addressed effectively.
- Extreme weather and natural disaster: happen frequently due to climate change.

Urban flood frequencies in China (



2. Development of wastewater treatment

China government view wastewater treatment and water reuse as a key strategy to address the current water resources crisis, urban water pollution and rapid urbanization

(1)Prioritized environmental protection and resource saving as the basic national policies by legislation and various documents.

(2)Financial support

- 380 billion RMB (about 60 billion dollars) was invested for wastewater treatment and water reuse facilities construction from 2005 to 2010 , 70 billion RMB was subsidized by central government.
- 430 billion RMB will be invested for wastewater treatment and water reuse facilities construction from 2011 to 2015

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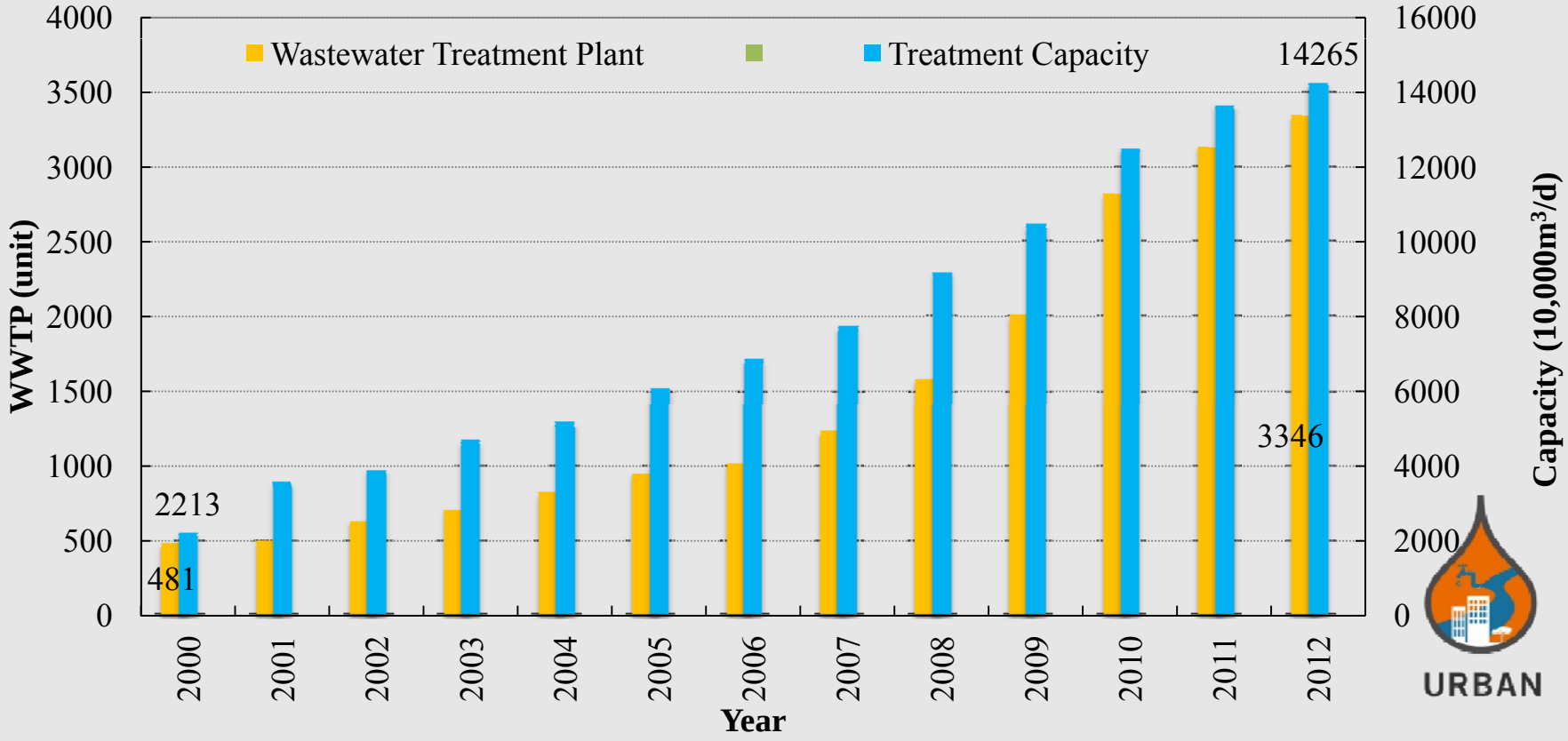
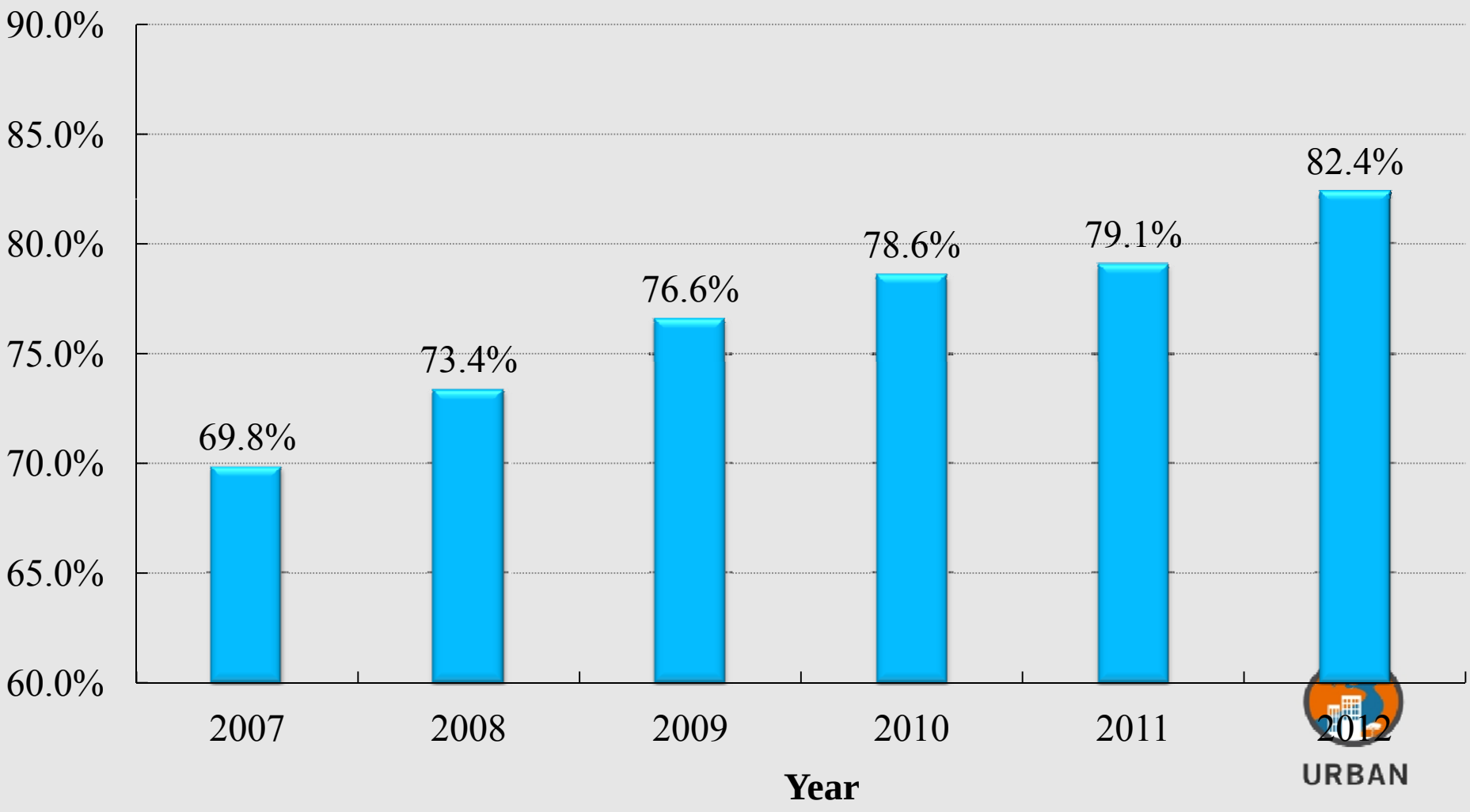
Wastewater treatment capacity increased considerably

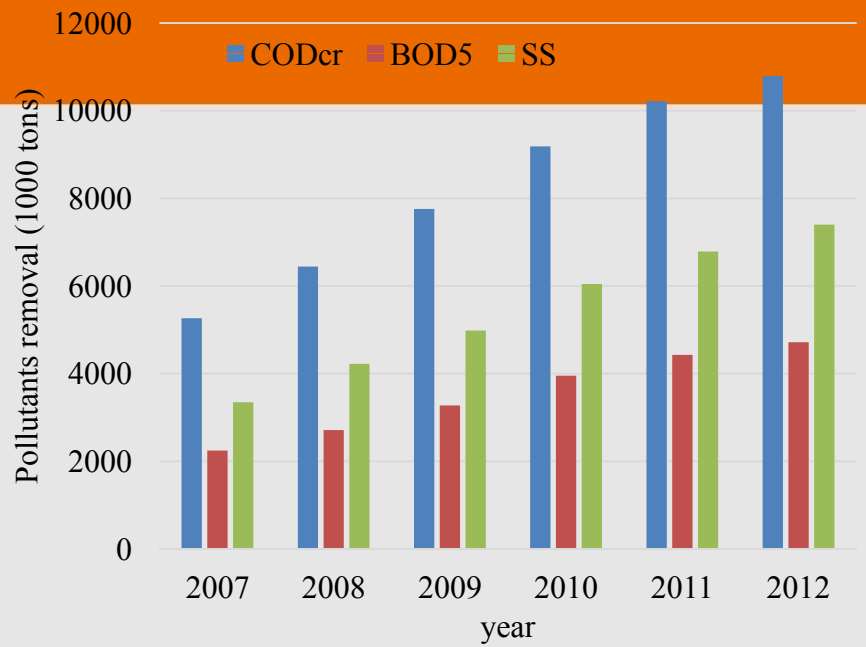
- 21st century has witnessed the significant growth of both WWTP(about 7 times) and its capacity (about 6.5 times)
- 3340 WWTP has been built with a total capacity of 142 million m^3/d in 657 cities and 1627 counties.
- 42.2 billion m^3 wastewater was treated in 2012 (country and town not included), population equivalent is estimated to be 600 million approximately.

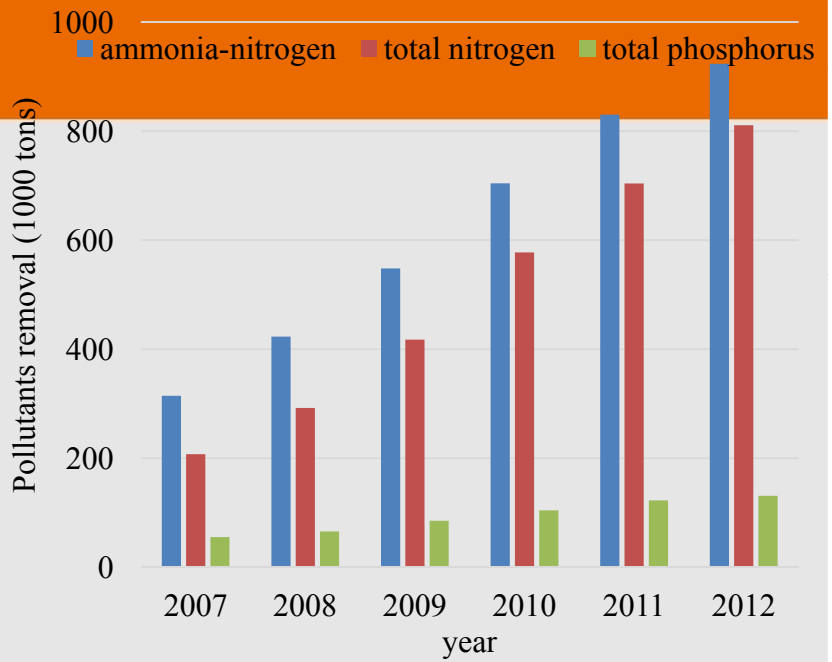


Average load rate of WWTP increased steadily



Pollutants removed increased gradually





year	COD_{Cr} removal	BOD_5 removal	SS removal	Ammonia-N removal	Total-N removal	Total-P removal
2007	5263	2244	3348	315	208	56
2008	6444	2710	4221	423	292	66
2009	7757	3272	4983	548	418	85
2010	9185	3953	6043	704	577	105
2011	10215	4426	6784	830	704	123
2012	10792	4716	7398	923	811	131

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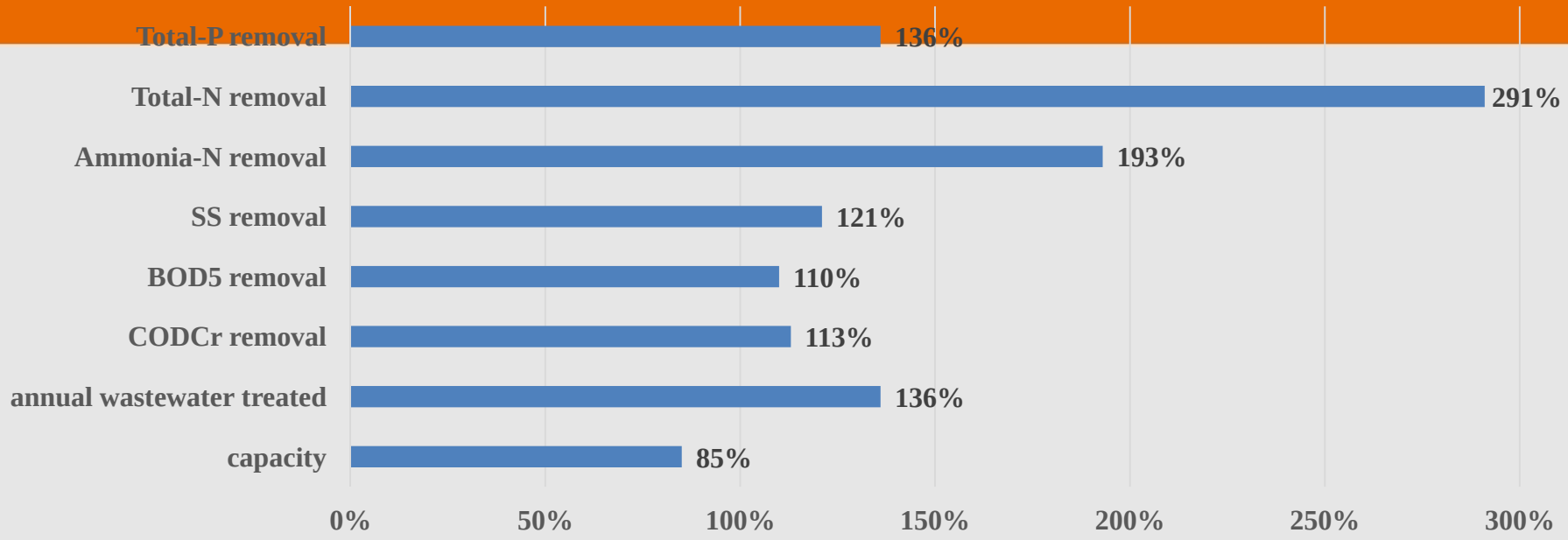
Pollutants removed increased gradually

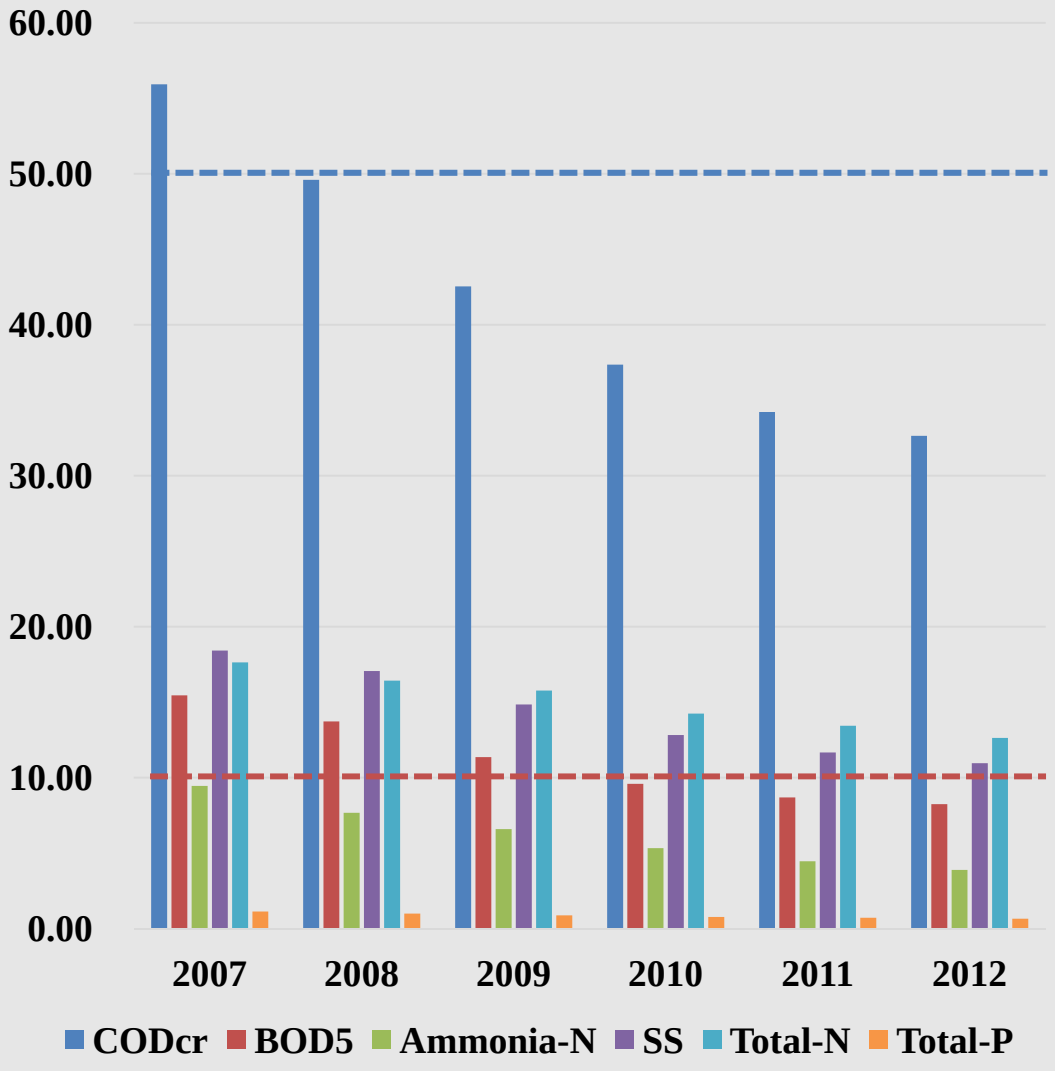
WWTP capacity, annual wastewater treated and pollutants removal increase from 2007 to 2012

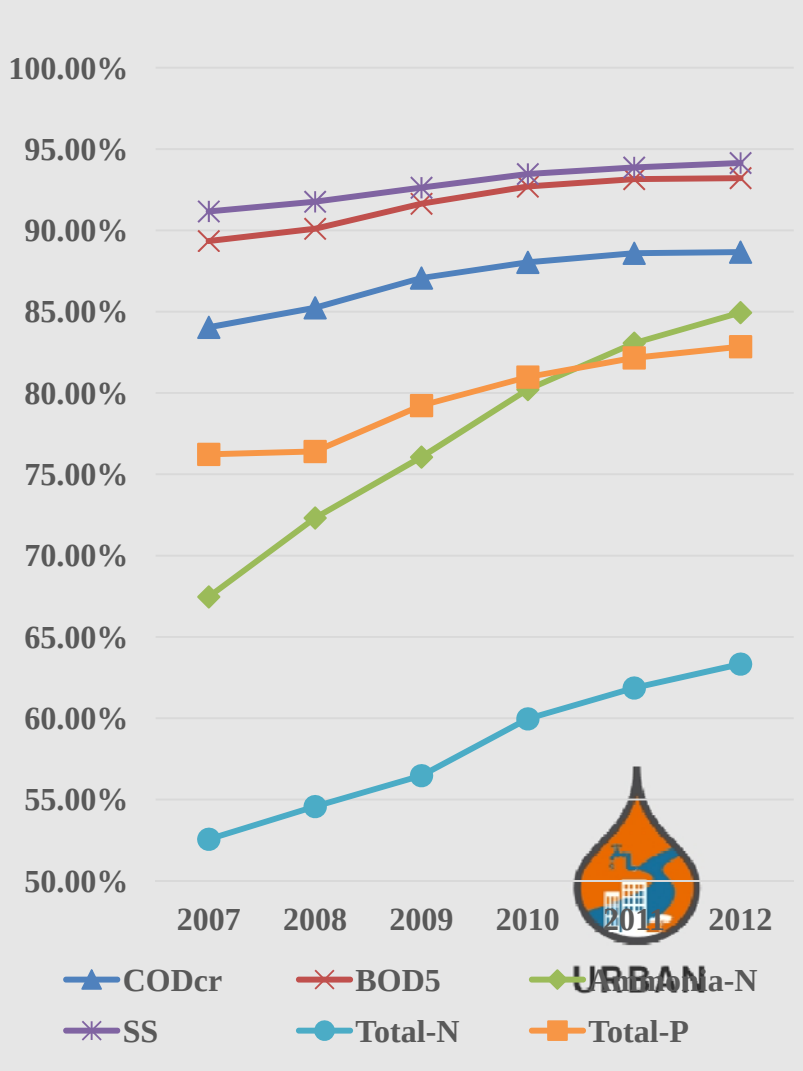


Annual increase of WWTP capacity, annual wastewater treated and pollutants removal (2007-2012)

year	capacity	annual wastewater treated	COD_{Cr} removal	BOD_5 removal	SS removal	ammonia-N	Tota-N	Total-P
2008	19.0%	25.7%	22.4%	20.8%	26.1%	34.5%	40.8%	18.5%
2009	13.9%	20.3%	20.4%	20.7%	18.1%	29.6%	43.0%	29.7%
2010	19.6%	23.3%	18.4%	20.8%	21.3%	28.4%	38.2%	22.3%
2011	9.1%	15.0%	11.2%	12.0%	12.3%	17.9%	21.9%	17.3%
2012	4.4%	9.9%	5.6%	6.6%	9.1%	11.2%	15.2%	7.0%

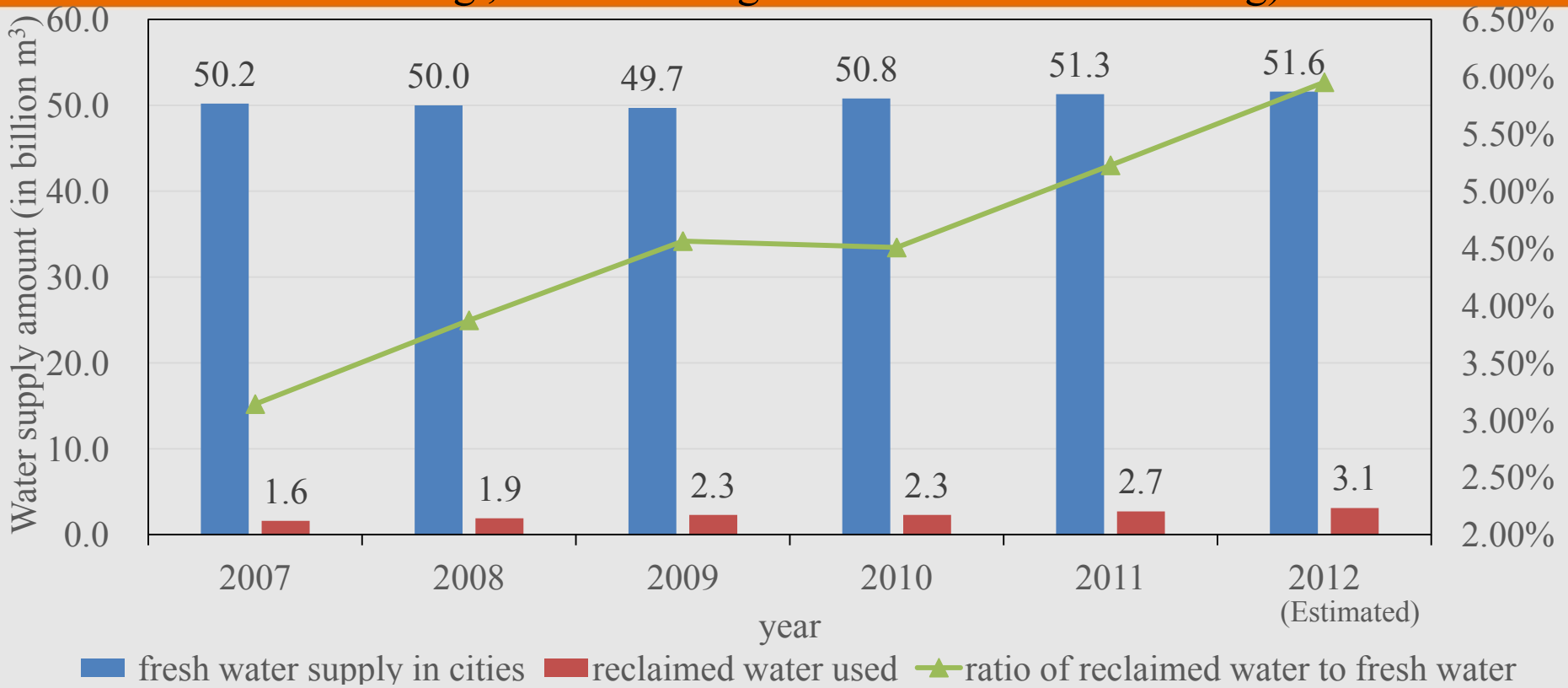
Pollutants removed increased gradually





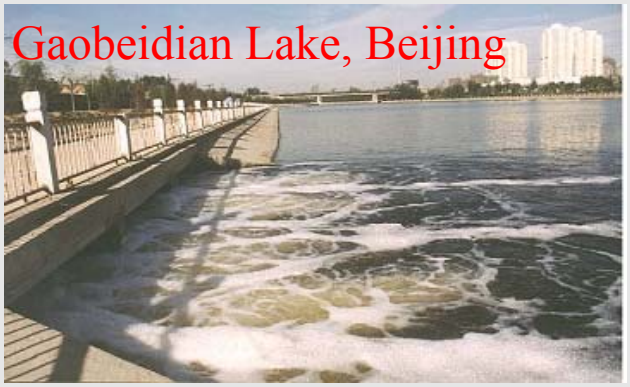
3. Reclaimed water in China: current status

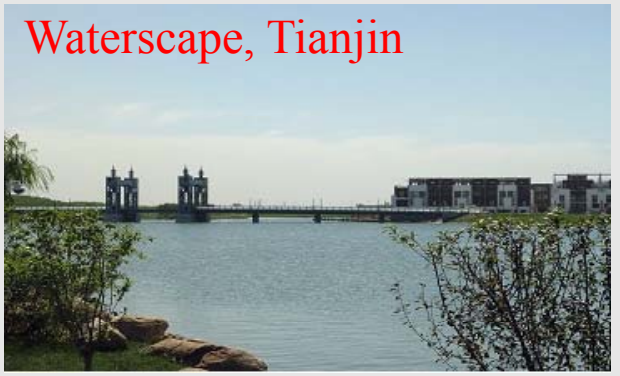
Annual water supply and reclaimed water usage in 657 cities (for gardening, road cleaning , toilet flushing and some industrial cooling)



3. Reclaimed water in China: current status

Besides, large amount of high quality reclaimed water were used for agriculture, landscape and ecology





4. Reclaimed water in Beijing

Beijing highly valued the importance of reclaimed water.

Taking the reclaimed water into the consideration of the balance of water resources allocation, which resulted in the relief of water resource crisis and reduction of pollutants discharge simultaneously.

In 2012, reclaimed water usage in Beijing was 750 million m^3, which is nearly 60% of the total wastewater treated and accounting for 20% of all the water consumed (including agriculture).

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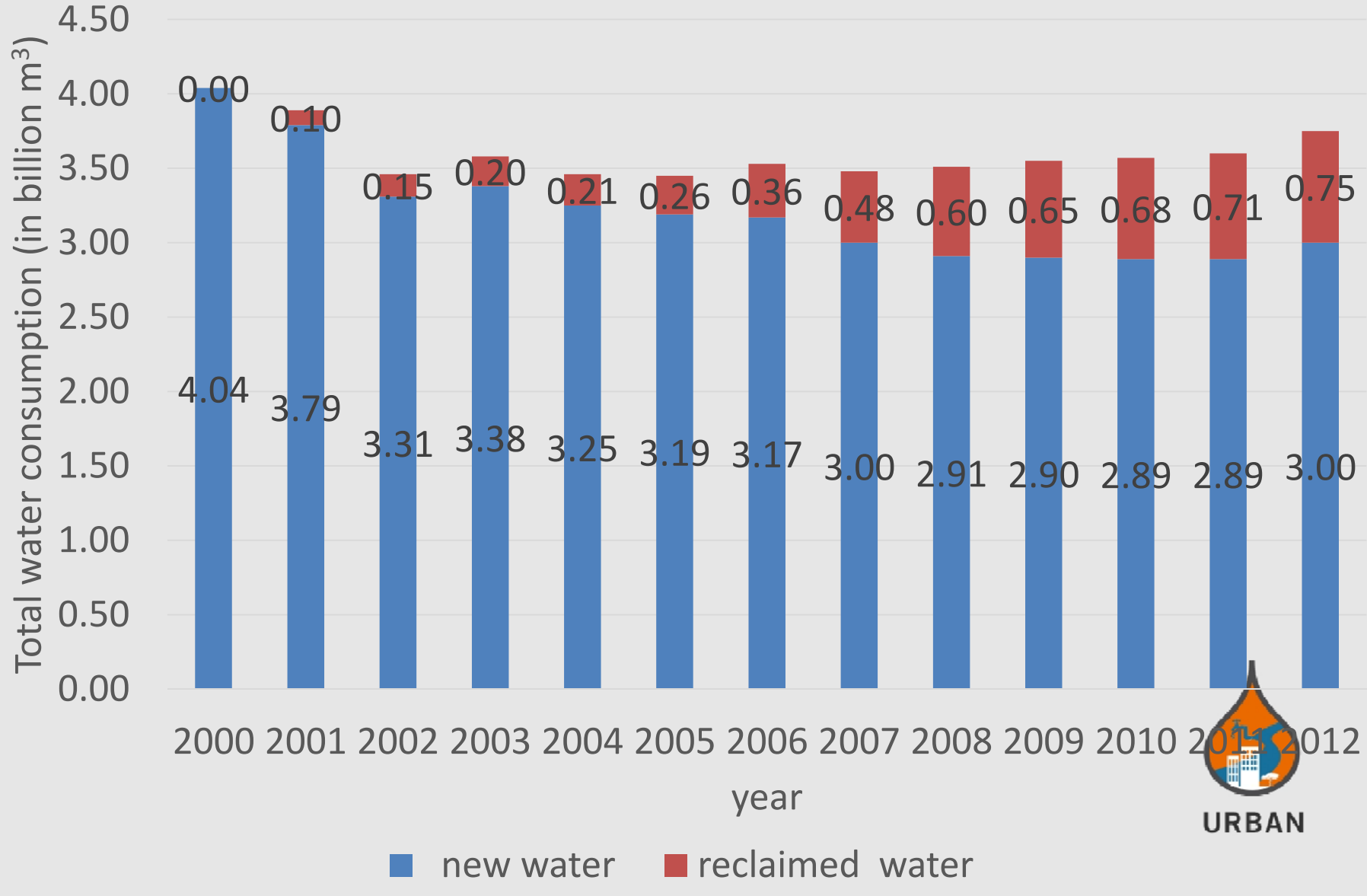
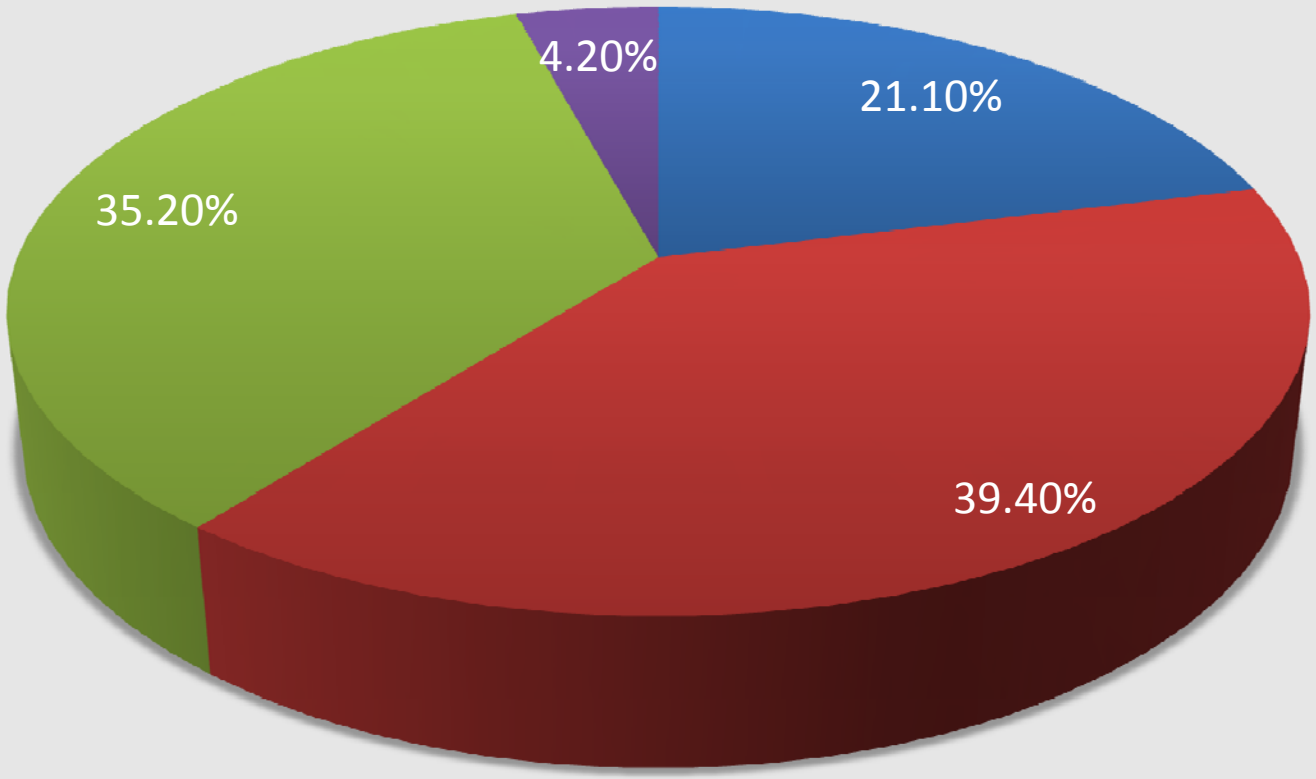
4. Reclaimed water in Beijing

Structure of total water consumption in Beijing in 2000-2012(including agriculture)



4. Reclaimed water in Beijing

Reclaimed water usage in different sectors in Beijing in 2011



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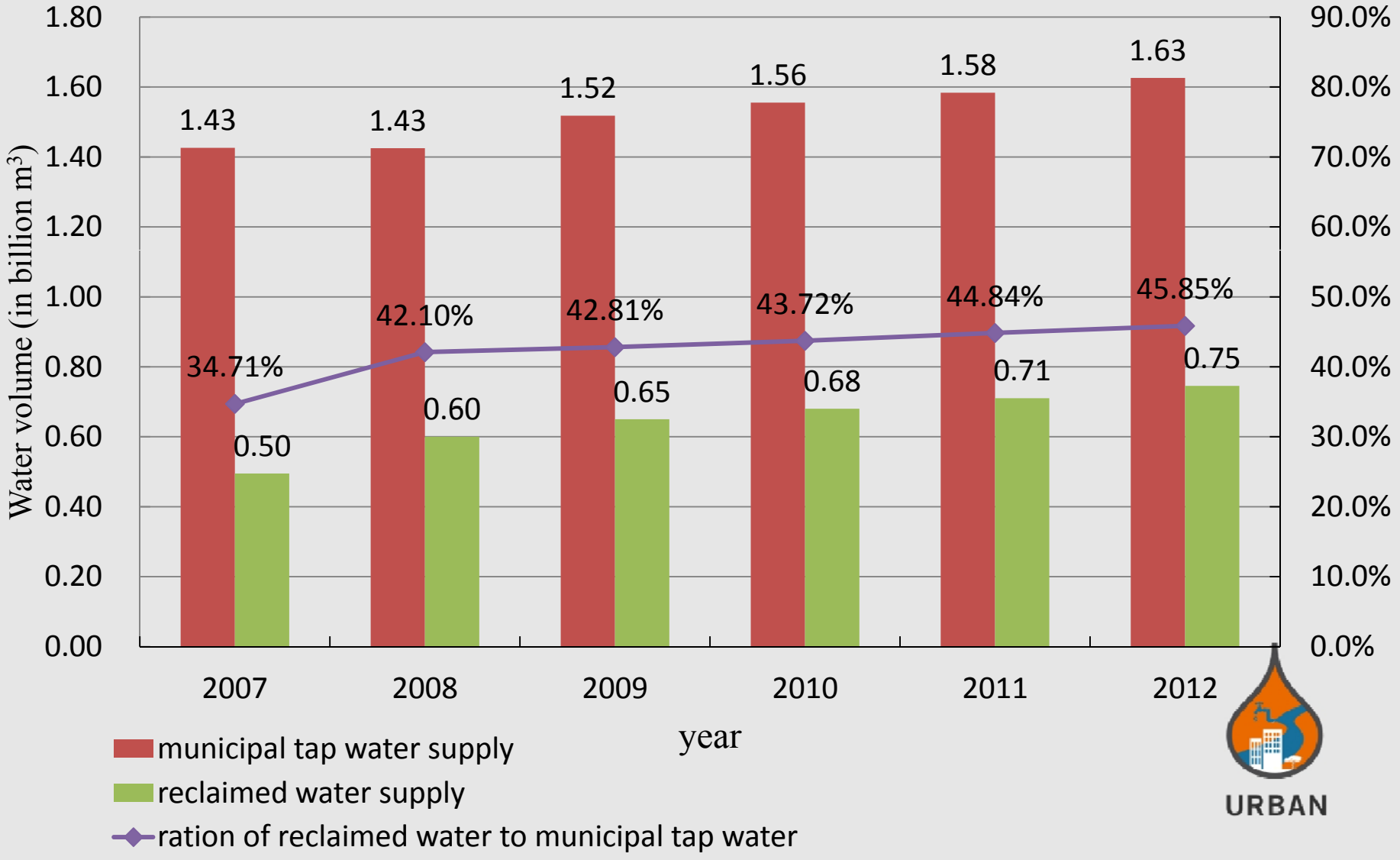
4. Reclaimed water in Beijing

Reclaimed water has became reliable and stable "second water source" for Beijing

Municipal tap water supply and reclaimed water usage in Beijing (agricultural irrigation not included)



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5. Ambitions and strategic measures

(1) Ambitions for 2015

- Raising wastewater treatment standard;
- Invest 30.4 billion RMB in reclaimed water facilities;
- Capacity building: increasing 26.8 million m^3/d and reaching a capacity of 40 million m^3/d in 2015.
- More than 15% wastewater should be reclaimed and reused in the national level;
- 100% wastewater in Beijing should be reclaimed and reused in Beijing;
- The effluent from the major WWTP in Beijing should meet the IV water body criteria (CODCr ≤ 30mg/L, BOD5 ≤ 6mg/L, total-N ≤ 10mg/L, ammonia-N ≤ 1.5mg/L, total-P ≤ 0.3mg/L)

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5. Ambitions and strategic measures

(2) Legislation

- "Water Law of P.R. China (2002)": China encourage reclaimed water production and usage.
- "Circular Economy Promotion Law of P. R. China (2009): China encourage reclaimed water production and usage. In some area, using municipal tap water for road cleaning, grassland irrigation and landscape should be restricted or prohibited.
- "China State Council's Inform Regarding Urban Water Saving and Water Pollution Control (2000[36])": Reclaimed water production and usage facilities should be planned and built with WWTP simultaneously in water deficient area.

5. Ambitions and strategic measures

(2) Legislation

- "China State Council's Inform Regarding the Promotion of Water Tariff Reform (2004[36])": Reclaimed water production and usage facilities should be planned and built with WWTP simultaneously in water deficient area. Safety of using reclaimed water should be guaranteed. Using price leverage to promote the using of reclaimed water.
- "Technology and Policy for Reclaimed Water (issued by Ministry of Housing and Urban-rural Development and Ministry of Science and Technology in 2006)": providing powerful policy support from many perspectives including planning, construction, operation, monitoring and technic innovation.
- "Technical Guidelines for Reclaimed Water in Urban Area(issued by Ministry of Housing and Urban-rural Development in 2012)": comprehensive guidance for reclaimed water including technical route, preferred processing technic, construction, O&M and risk reduction.

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5. Ambitions and strategic measures

(3) Various national Criteria

- Reclaimed Water Usage Classification
- Reclaimed Water Quality for Municipal Use
- Reclaimed Water Quality for Landscape
- Reclaimed Water Quality for Groundwater Recharging
- Reclaimed Water Quality for Industrial Use
- Reclaimed Water Quality for Agricultural Irrigation
- Reclaimed Water Quality for Grassland Irrigation

- Design Standard for Reclaimed Water in Buildings
- Design Standard for Reclaimed Water Engineering

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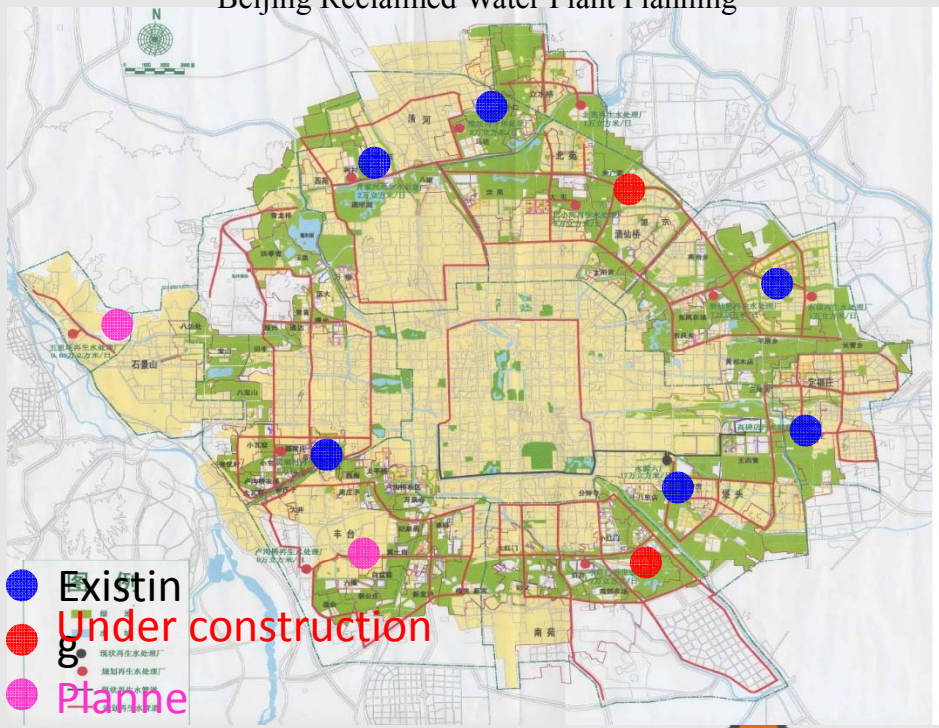
5. Ambitions and strategic measures

(4) Promotion of reclaimed water facilities building

- Continue on capacity building of Reclaimed water facilities.

Beijing Gaobeidian WWTP and Reclaimed Water Plant

Beijing Reclaimed Water Plant Planning



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5. Ambitions and strategic measures

(5) Concentration on technology advancement

- advanced treatment, P, N removal;
- Membrane technology, Ozone disinfection
- More funding from “National Special Research Project on Water”

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5. Ambitions and strategic measures

(6) Reclaimed water friendly policies from economic perspective

- Subsidize from central government for the reclaimed water plant construction (up to 30%-40%);
- Operation subsidize from government;
- Tax-free policy for reclaimed water plant.
- Competitive tariff (no water resource charges, no wastewater treatment charges)

Comparison of water tariff and reclaimed water charge

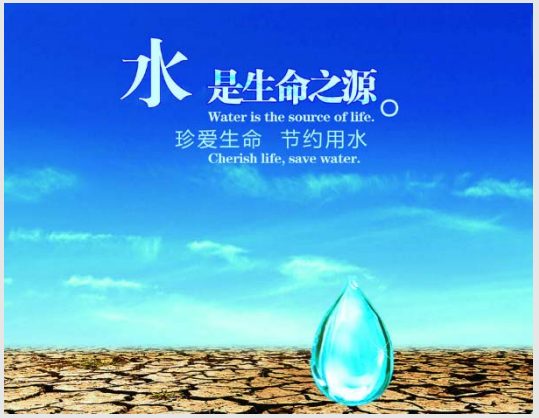
city	water tariff, RMB/m^3				reclaimed water charge, RMB/m^3		
	domestic	industrial	others	special	domestic	industrial	landscape
Beijing	3.7	5.6	5.4	41.5	1.0	1.0	1.3
Tianjin	2.9	4.6	4.6	18	1.1	1.3	1.5
Xi'an	1.95	2.25	2.55	6.5	1.17	1.17	1.17
Qingdao	1.6	2.0			1.0	1.0	1.0
Shijianzhuang	2.6	3.7	3.5	24.7	1.0	1.0	1.0

Data source: Zheng Xingcan, the World Bank report on North China Water Quality Study Program: Urban Water Reuse Study, 2010.

5. Ambitions and strategic measures

(7) Awareness raising and public participation

- Some potential industrial users and residents cannot accept reclaimed water mentally ;
- Through various media, explain importance of water reuse and reliability of reclaimed water;
- Paying attention to demonstration projects
- Invite people to visit urban water reuse facilities



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Reclaimed Water Plant in Beijing

Qinghe Reclaimed Water Plant in Beijing, largest using Membrane

Jiuxianqiao Reclaimed Water Plant in Beijing

Beixiaohe Reclaimed Water Plant in Beijing, using RO

Wujiacun Reclaimed Water Plant in Beijing

Reclaimed Water Usage in Beijing

Grassland Irrigation

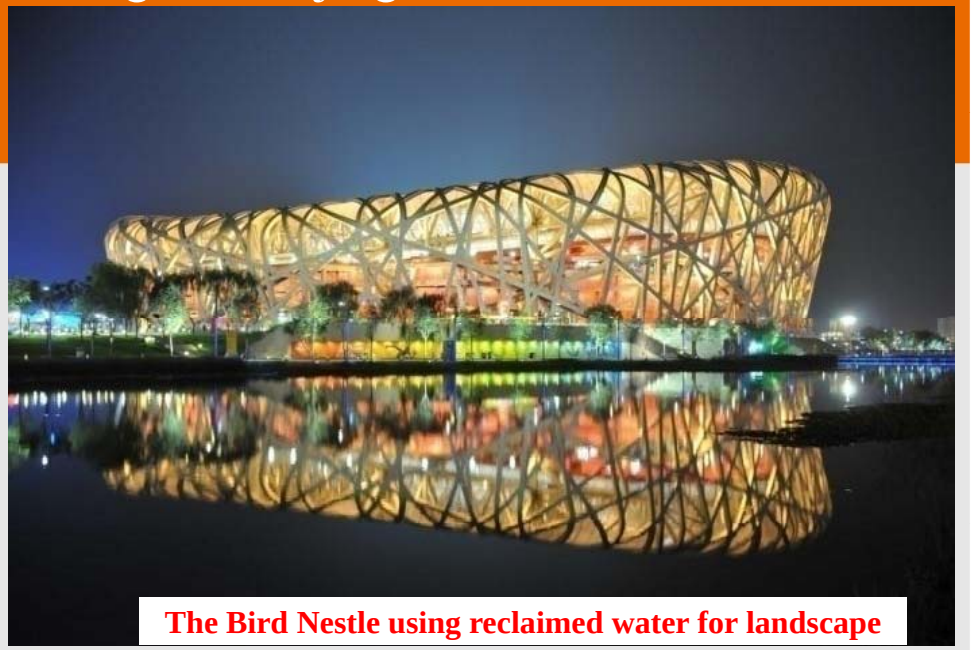
Agricultural Irrigation

Road Flushing

Reclaimed Water Filling Auto-service Station in Beijing

Reclaimed Water Usage in Beijing

Huaneng Power Plant using reclaimed water for cooling



The Bird Nestle using reclaimed water for landscape

Yuanmingyuan Park using reclaimed water for landscape

Beitucheng River using reclaimed water for supplement