

A large, irregularly shaped stone monument with the Chinese characters '同濟大學' (Tongji University) carved into it. The monument is set on a circular base in a paved plaza. In the background, there are modern university buildings and trees under a clear sky.

**Semi-centralized supply and
treatment systems for fast-
growing urban areas**

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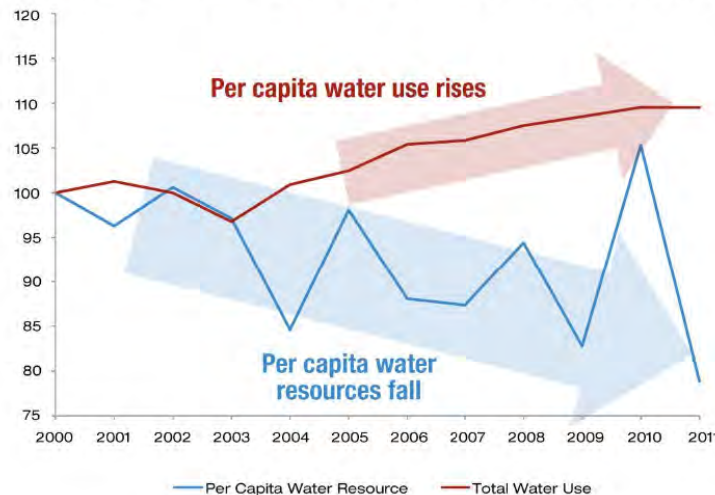




China Water Crisis

! Water resources are falling whilst demand for water rises

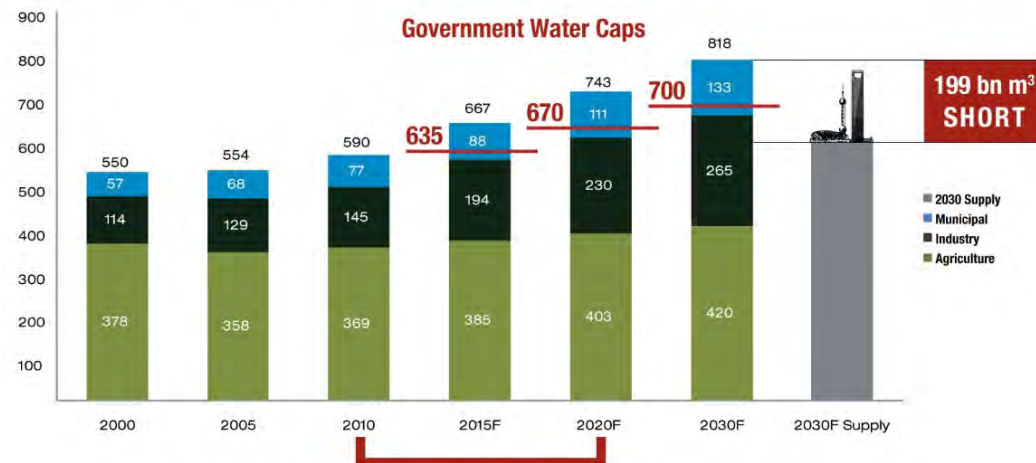
2000-2011: Falling water resources & rising water use per capita



- The central government moved water to the top of the agenda in 2011. National water usage caps are 635 billion m³, 670 billion m³ and 700 billion m³ by 2015, 2020 and 2030 respectively

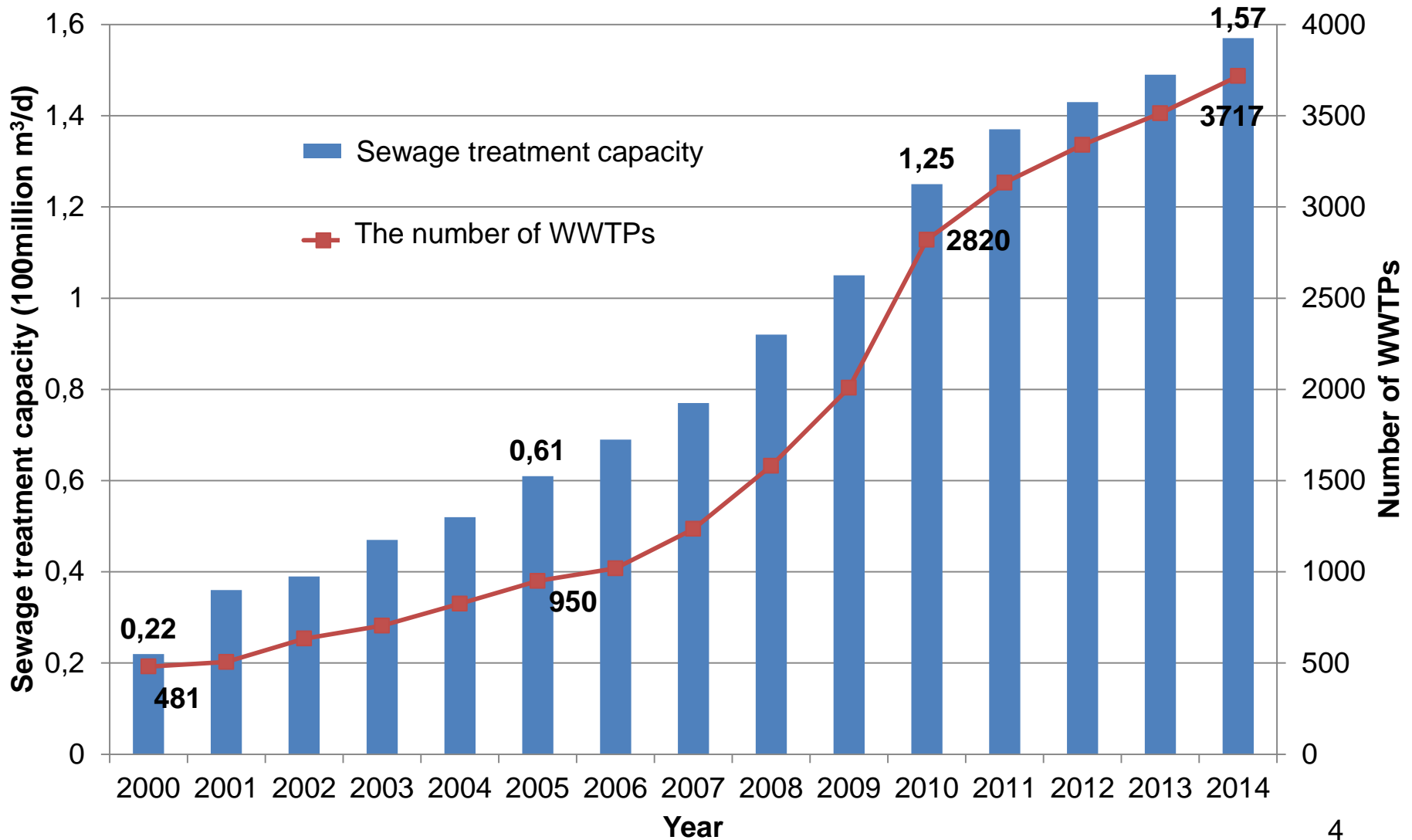
- If we carry on with business as usual, the supply of water will not be able to meet the demand for water by 2030. The shortage will be 199 billion m³.

2000-2030 Water Demand & Water Caps (billion m³)



RMB 4 trillion to be spent on water infrastructure 2011-2020

Wastewater Treatment



Problems

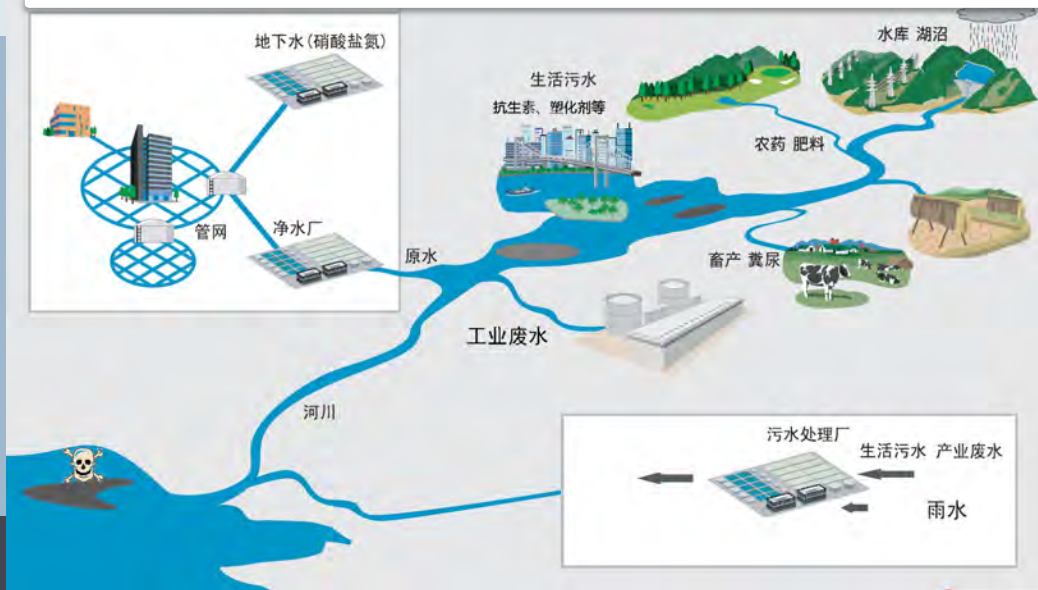
- Low reuse rate of water resources
- Waterlogging due to not complete facilities
- Lack of uniformity and standardization of drainage procedures
- Incorrect maintenance and management of facilities
- Sludge treatment and disposal should be standardized
- Lack of supervision, accountability not clear



Bottlenecks – Technological Innovation



Complex group of pollutants,
beyond environmental carrying capacity

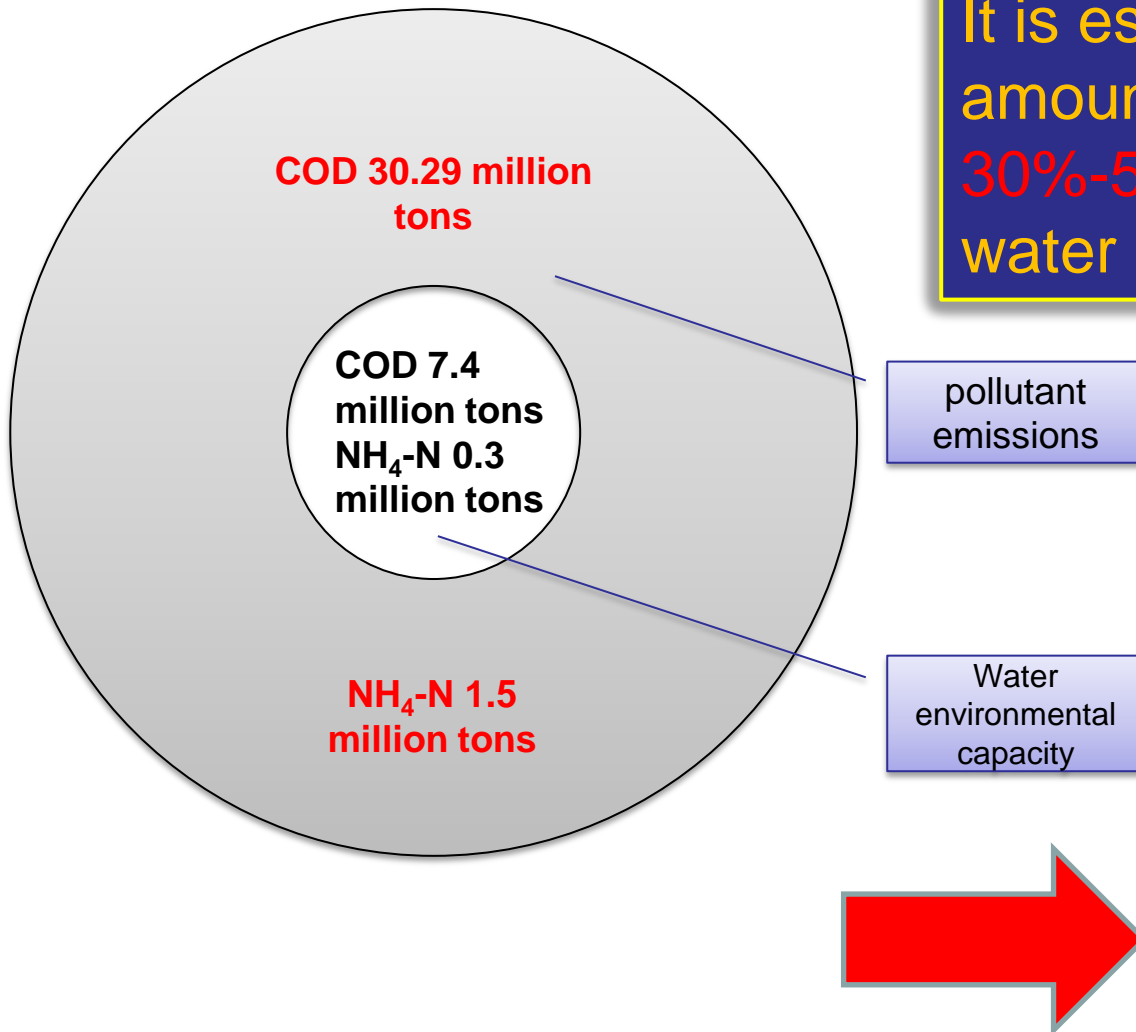


Pollution approach appeared during 30 years in China though in developed countries it took hundreds of years;
Existing technologies can not solve these problems of complex pollution;
Breakthrough of existing processes can not solve the problems of water environment.

Water Environmental Capacity



It is estimated that the total amount must be reduced by 30%-50% to change the water environment.



- “three red lines” policy
- Ten Measures on Water

Sponge City



Traditional City

- Transformation of nature
- Change the original ecology
 - Extensive construction
 - Increasing surface runoff

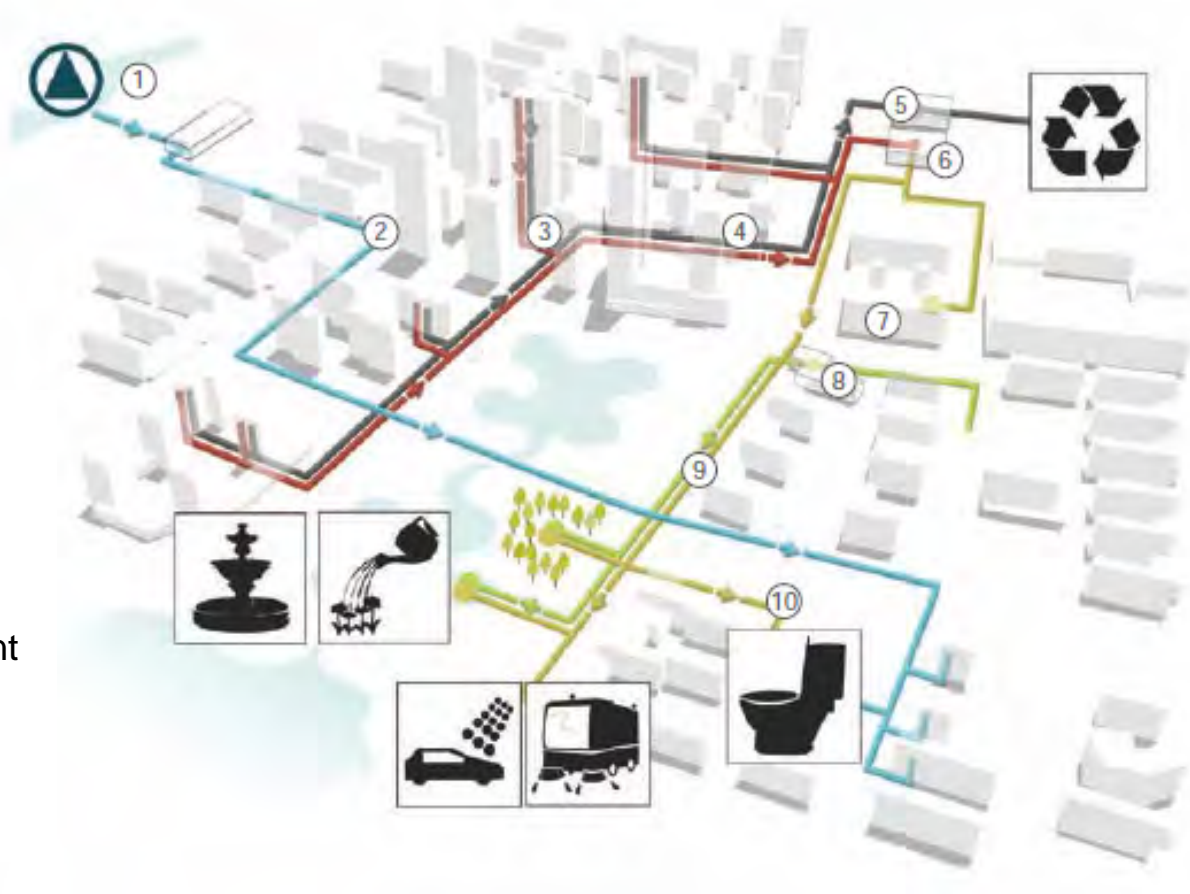


Sponge City

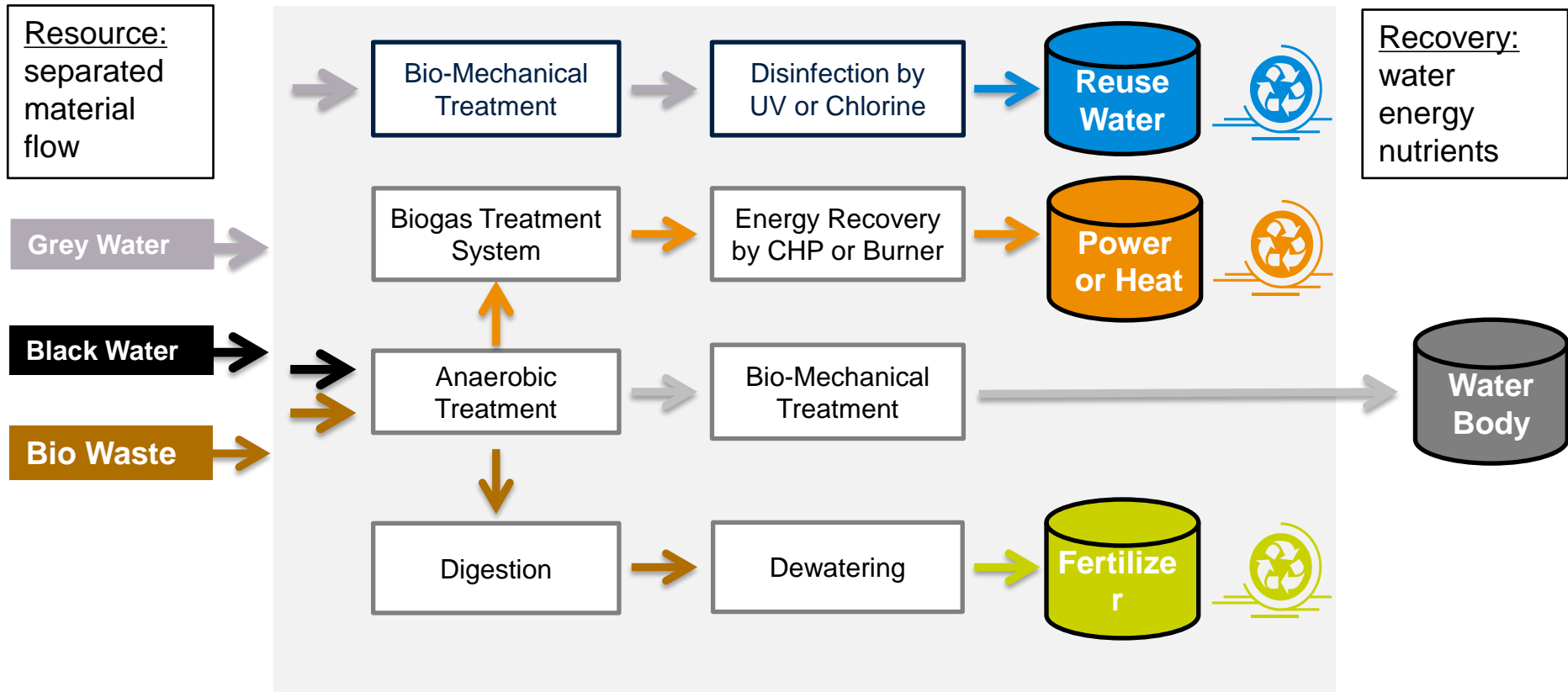
- In harmony with nature
- Ecological Protection
 - LID
 - Unchanged surface runoff

Water and Sewage Network

- 1 Water supply
- 2 Fresh water
- 3 Wastewater
- 4 Grey water
- 5 WWTP
- 6 Water Reclamation Plant
- 7 Industrial water
- 8 Rainwater treatment
- 9 Treated rainwater
- 10 Treated grey water



Wastewater as a Resource



Source: Gerlach 2015, Bilfinger Water Technology

Source Separation



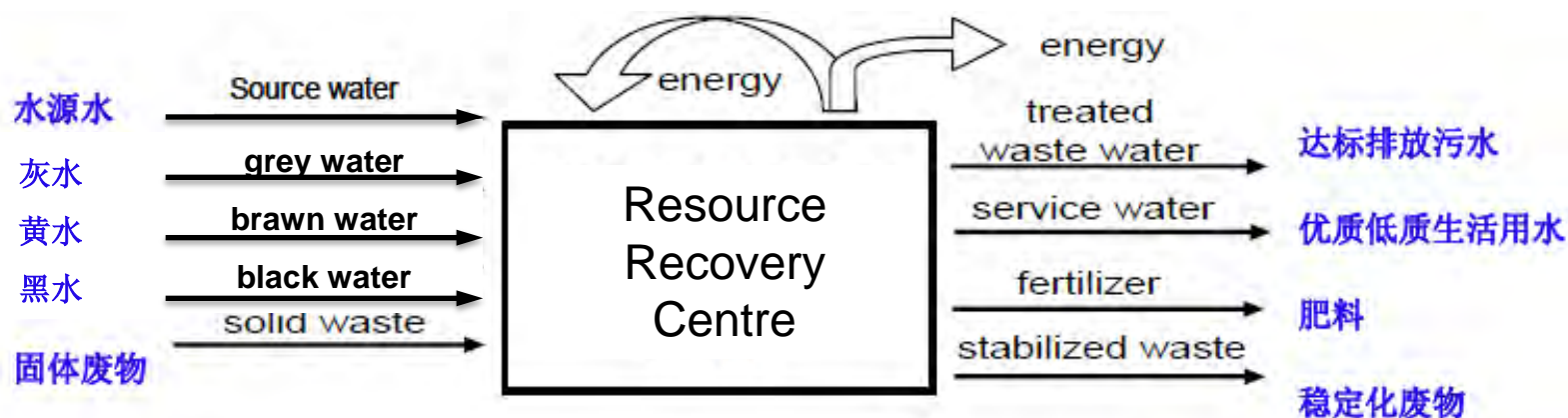
		wastewater		
		Gray water (flushing, washing)	Brawn water (urine)	Black water (manure)
Quantity	150 l/PE.d	99%	0.9%	0.1%
CO D	82 g/PE.d	41%	12%	47%
N	14.1 g/PE.d	5.6%	81.6 %	12.8 %
P	2.5 g/PE.d	20%	60%	20%
K	1.8 g/PE.d	34%	54%	12%



Source Separation

Advantages:

- 🔥 Organic energy recyclable, save energy
- 🔥 Recovery of 80% P and 95% N
- 🔥 Saving water 30-40%



Semi-centralized supply and treatment



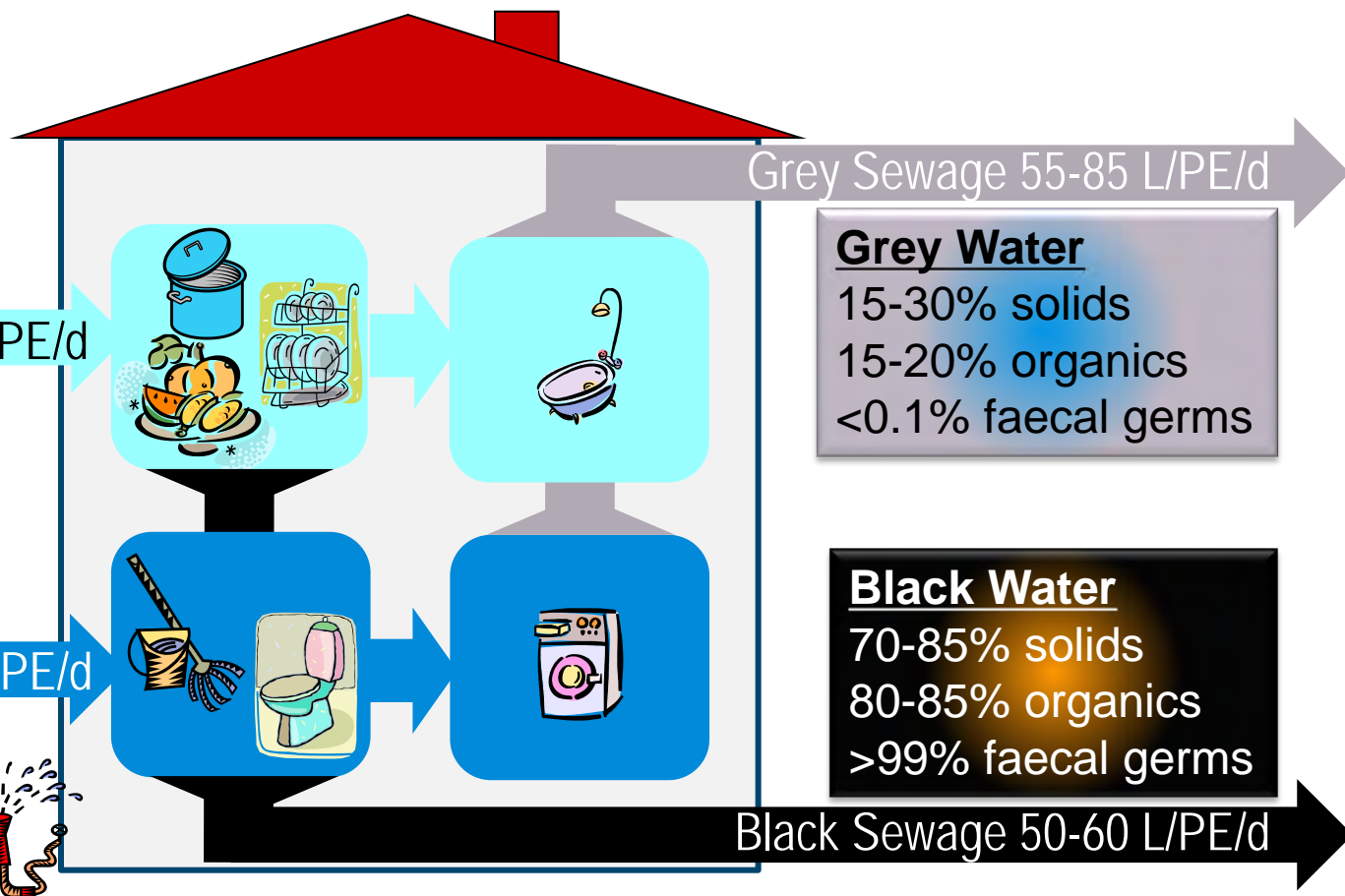
Potable Water
acc. to standard
taken & treated from
protected resources

Potable Water 35-65 L/PE/d

Service Water
clear + odourless
biologically stable
safe + hygienic

Service Water 70-90 L/PE/d

0-10 L/PE/d

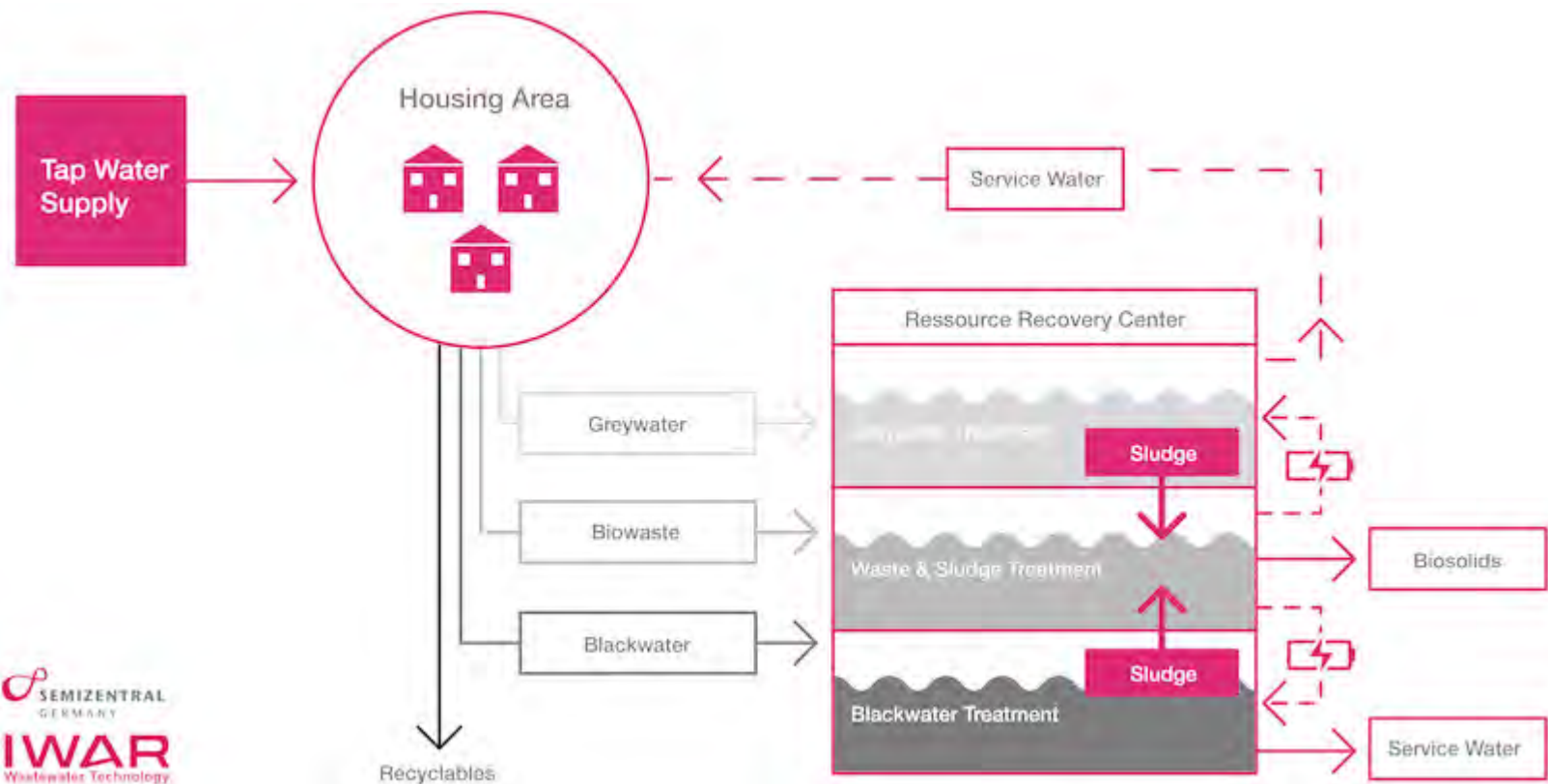


Grey Water
15-30% solids
15-20% organics
<0.1% faecal germs

Black Water
70-85% solids
80-85% organics
>99% faecal germs

Semi-centralized Eco City

Semi-centralized supply and treatment systems offer a future-oriented and resource-conserving alternative to conventional centralized systems.



Background of Sino-German Project



- On June 28, 2011, in the presence of Premier Wen Jiabao and Federal Chancellor Angela Merkel, a joint declaration on the research and innovation program “Clean Water” was signed by MoST and BMBF.
- On January 9, 2012, a memoranda about establishing a semi-central demonstration plant in Qingdao was signed by People’s Government of Qingdao, Tongji University and Technical University of Darmstadt.
- In March 2012, the plant was allowed by WHE Committee to be built in Expo Village.



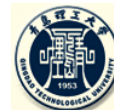
Sino-German Cooperation



- Research on efficient environmental protection and resource management systems
 - Nearby sewage treatment and reuse
 - Nutrients recycling
 - Energy recycling
 - Bio waste co-fermentation
 - Source separation
- Concept semi-centralized supply and treatment systems
- Implementation of a semi-centralized supply and treatment center (STC) in Qingdao



同濟大學
TONGJI UNIVERSITY



青島理工大學



Sino-German Cooperation

- It was led by Tongji University and TU Darmstadt, combined with institutions and enterprises from CN and DE.



Prof. Dr.-Ing. Peter Cornel



Prof. Dr.-Ing. Xiaohu Dai



中德两国专家全程参与到示范中心的建设中。

The construction of the Demonstration Center was supported by experts from both China and Germany.



Semi-centralized System in Qingdao



**Worldwide first
Resource Recovery
Center in Qingdao, PR
China**

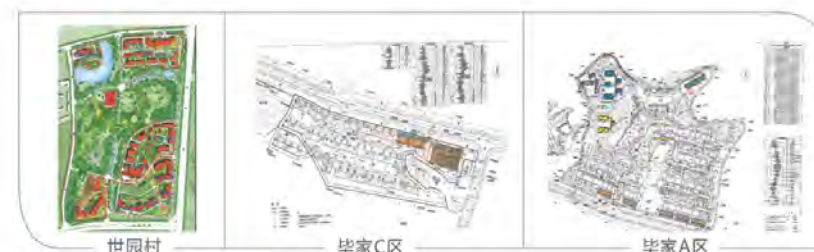
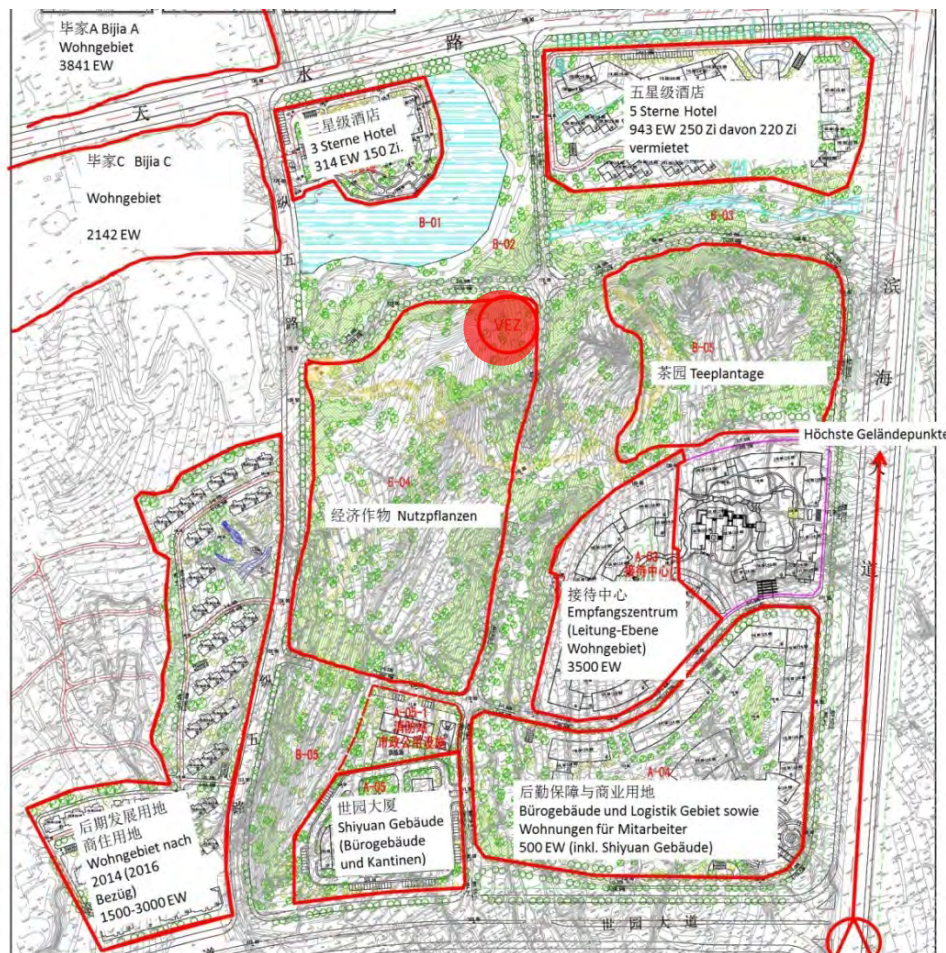
Treatment scale:

- Grey water: 700m³/d
- Black water: 800m³/d
- Bio-waste: 22.93m³
(3.44 tons DS)

SemiZentral RRC in Qingdao, China

Area Chart

- 12,000 residents connected



示范中心服务范围为：

Source: WHE

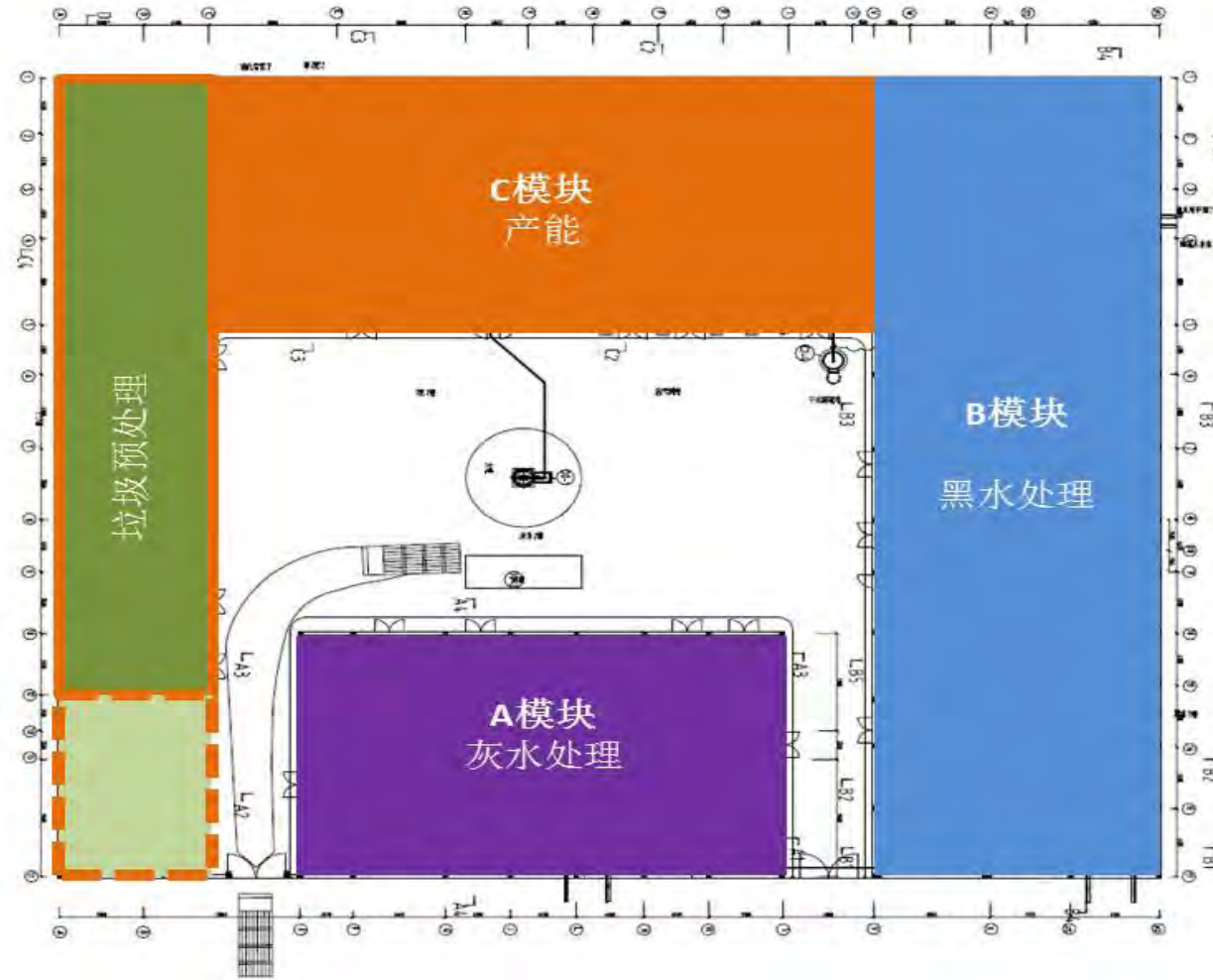
青岛世界园艺博览会世园村（建筑面积约40万平方米）、毕家安置工程A、C片区（建筑面积约27.2万平方米）及2014年后部分新建住宅区。

The service area of the Demonstration Center covers the Expo Village of International Horticultural Exposition Qingdao (construction area: 400,000 m²), Bija Residential Areas A + C (construction area: 272,000 m²) and other residential areas which will be built after Expo 2014.

Module



- Greywater Treatment
- Blackwater Treatment
- Sludge/Bio Waste Treatment and Energy Center
- Waste Pretreatment



Source: CHEN 2014 IE EXPO, Tongji University

Greywater Module

- Wastewater from showers and washing machines
- Using MBR process
- reused as service water for toilet flushing
- Daily water consumption is reduced by at least 30%-40%

Source: Wagner 2014 IE EXPO, TU Darmstadt



Blackwater Module

- Blackwater from toilets and kitchen workflows drains
- Using MBR process
- reused for irrigation



Source: Wagner 2014 IE EXPO, TU Darmstadt



Waste Pretreatment Module



Source: CHEN 2014 IE EXPO, Tongji University

Energy Center Module

- Co-fermentation of biowaste and sludge
- Thermophilic digestion
- Conversion of biogas: Using CHP
- Energy self-sufficient operation of the STC
- Land use of the production



Source: CHEN 2014 IE EXPO, Tongji University

Opening ceremony 27.04.2014



Source: Wagner 2014 IE EXPO, TU Darmstadt / CHEN 2014 IE EXPO, Tongji University





GreenTec Awards 2015

SEMIZENTRAL has received one of the GreenTec 2015 awards in the category “Urbanization”.



Source: GreenTec Awards / Wagner 2014 IE EXPO, TU Darmstadt



Key Advantages

- Change the traditional concept of wastewater treatment, resource recycling and environment-friendly
- Processing center close to the user terminal, saving transport costs and pipeline investment
- Most efficient use of water offering 30-50% reduction of fresh consumption
- Energy self-sufficient operation by co-digestion with sludge and biowaste
- Harmlessness and stabilization of biosolids, can be used as fertilizer
- High integration, easy to construct and manage operation

Thank you!

