CHINA WATER MARKET AND TECHNOLOGY OUTLOOK 2021

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Colophone

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Key References:

EU Chamber of Commerce China Position Paper 2021-2022
https://www.europeanchamber.com.cn/en/publications-position-paper

CEWP: Conclusions and main findings from events about Industrial Water (2019):
https://www.cewp.eu/sites/default/files/files/Final%20Draft%20Report%20from%20EU%20China%20Water%20Developmner%20Forums%20in%20Chengdu%20and%20Qingdao%20November.pdf

CEWP: Conclusions and main findings from events about Urban Water (2021):
https://www.cewp.eu/sites/default/files/2021-11/CEWP%20Webinar%20Series%202021%20Draft%20Consolidated%20Report%201406211%20HEDIS.pdf

Presentations and interventions at CEWP webinars and events: https://www.cewp.eu/news-events

Circular Economy in the Wastewater Sector

https://www.cewp.eu/sites/default/files/2021-05/CEWP_Whitepaper_Circular%20Economy%20of%20Water%20in%20Waste%20Water%20Treatment_final.pdf

China Carbon Neutrality 2030/2060 in the Water Sector

https://www.cewp.eu/sites/default/files/2021-05/China%20WW%20carbon%20neutrality%203060%20path%20and%20solution%20report_NORDIQ0428.pdf

China Water Risk: https://www.chinawaterrisk.org/resources/analysis-reviews/looking-for-water-in-chinas-14fyp/

Global Water Intelligence, Global Water Market 2017 https://www.globalwaterintel.com/products-and-services/market-research-reports/global-water-market-2017

Mordor Intelligence https://www.mordorintelligence.com/industry-reports/china-water-and-wastewater-treatment-wwt-technology-market

Qianzhan Industry Research Institute https://www.qianzhan.com/analyst/detail/220/210802-5abeea82.html (in Chinese)

CHINA WATER AND TECHNOLOGY MARKET OUTLOOK 2021

Summary

Following the launch of the Chinese Governments' 14th 5-Year Plan in March 2021, expectations to the development of the Chinese Market for Water Technologies in the coming years are very high. For the years 2021 to 2026, additional growth of around 10% per year is foreseen, with some sources predicting China to become the World's largest market for water technology by 2025.

Altogether, the Chinese Market for Water Technology hereby consolidates its position as one of the most important markets for companies working with an international agenda.

The challenges facing the Water Sector could to a very large extent be addressed, if already existing solutions were fully utilized. Although need for technological innovation still exists, the main needs are for systemic innovation reg water management and market functioning. Cheaper bulk solutions are preferred due to lack of adequate financing models, economic frameworks promoting long-term sustainability as well as inadequate regulatory frameworks.

However, the opportunities look very different for international companies already established at the Chinese market, and those considering to do so. Several companies already established at the Chinese Market have shown to be able to grow in this market, delivering very strong economic results during the Pandemic, while companies considering to enter already before the Pandemic faced huge obstacles regarding travelling and market entry initiatives.

Obviously, absence from the market in more than 3 years (2020 and 2021, and expectedly also 2022) for non-established companies will imply a strong element of "starting-all-over-again" regarding market understanding, revitalizing partnerships, relations and network, as well as increased competition from local market players with new and improved solutions.

Having said this, other factors points to a more level-playing-field market, e.g. with solving problems related to IP-fraud improving and an overall better business environment for SMEs emerging. With SMEs often being the provider of new solutions, they are very important of technology transfers as a contribution to prevailing water management challenges. In this context, it is in the interest of China to facilitate entry of new players to the market.

Further, with the appetite for digitalized solutions continuously growing in the Chinese water sector, and strong interest in state-of-the-art technologies thriving, international companies able to find the right niche and having the right understanding for adopting to local needs and conditions are still able to do very good business in China.

At the same time, despite the Chinese Governments' strong ambitions for improving the quality of the environment, including water, as reiterated in the targets of the 14th 5-Year Plan, the market functioning has developed at its own path and pace, with most tenders being made according to older standards, hereby de-facto favoring bulk/standard solutions rather than state-of-the art solutions.

To conclude, while exploring the vast scale and growth rates of the Chinese Market, companies will be recommended to be well-prepared and considerate about their anticipated market niche and market entry strategy. Further, to facilitate international technology transfers as a means to addressing the water quality and water supply challenges, improving market access for international companies is highly recommended.

Introduction

This CEWP China Market Outlook 2021 report summarizes market development, market entry opportunities and related challenges, especially seen in the perspective of companies considering to enter the Chinese Market for Water Technology.

The 14th 5-Year Plan, approved by the Party Congress in March 2021 sets the scene for the market in the years to come. This report summarizes the main elements of the 14th 5-Year Plan. Further, the report aim at establishing a drawing up changes at the market and its functioning in the context of the Pandemic, which has forced many international companies to be absent from the Chinese market for water technologies.

In an upcoming post-Pandemic situation, previous partnerships and relations needs to be revisited and rebuild, taking into account a market and technology landscape which has changed, with regulatory initiatives and digitalization being the main drivers.

Also, with the abovementioned external factors settled, the CEWP China Market Outlook 2021 report summarizes the discussions at the CEWP Urban Water Webinar series held in Spring 2021 as well as 3 physical events held in Shanghai, Wuhan and Amsterdam in June and November 2021, respectively.

In addition, the report draws up the main conclusions of the EUCCC Position Paper 2021/2022 and key findings and recommendations of the EU SME Centre, especially with regard to addressing market barriers. Based on the reports elaborated in connection with the webinar series, the main findings regarding new, technical solutions and business models are drawn up.

Finally, the report lists a number of suggestions for Policy Recommendations regarding Chinese-European Business Co-operation and its contribution to addressing the vast, global changes within the Water Sector, as well as adjoined technology transfers following international trade.

Reader's Guidance

The following bullets are a non-exhaustive list of suggestions for reflections, while reading the report.

Chinese authorities

- Within which water sector challenges will technology transfer via trade and export be of particular importance?
- How can a value chain analysis connect the regulatory initiatives with the market functioning, i.e. does the market request long-term sustainable and cost-efficient solutions or cheaper, bulk solutions with less long-term value, contribute to increasing efficiency of delivering the targets within a cost-efficient use of public funds/expenditures?

European authorities

- Which water management challenges, technology gaps or market barriers are shared by China and Europe, hereby constituting foundation for further co-operation?

European companies not yet established in China

- Can you do business in China? Is your technology relevant to Chinese customers? Which niche have you identified? Who are your competitors and what are their market position?
- Is your market segment subject to a strong momentum regarding innovation? Will it be of strategic importance for you to grow and develop with and at the Chinese Market?
- What will the best market approach for you to this market? Which relations will support your market entry efforts?
- Have you considered setting up a Joint Venture with a Chinese company? Or should you start with a project orientation? What are your reflections about a sales structure, and eventually working via sales agents? How will you provide your customers with service and maintenance?
- And, before reading, you could try the "Ready for China" quiz made by the partner organisation of the CEWP: the EU SME Centre in Beijing, and have a glance at their services now that you are visiting their website: https://www.youtube.com/watch?v=OPhBW7I7Y8A

European companies in China

- Which change of framework conditions e.g. pricing structures and incentives reflecting true cost of ownership, will help promoting state-of-the-art solutions and long-term sustainability within your field?

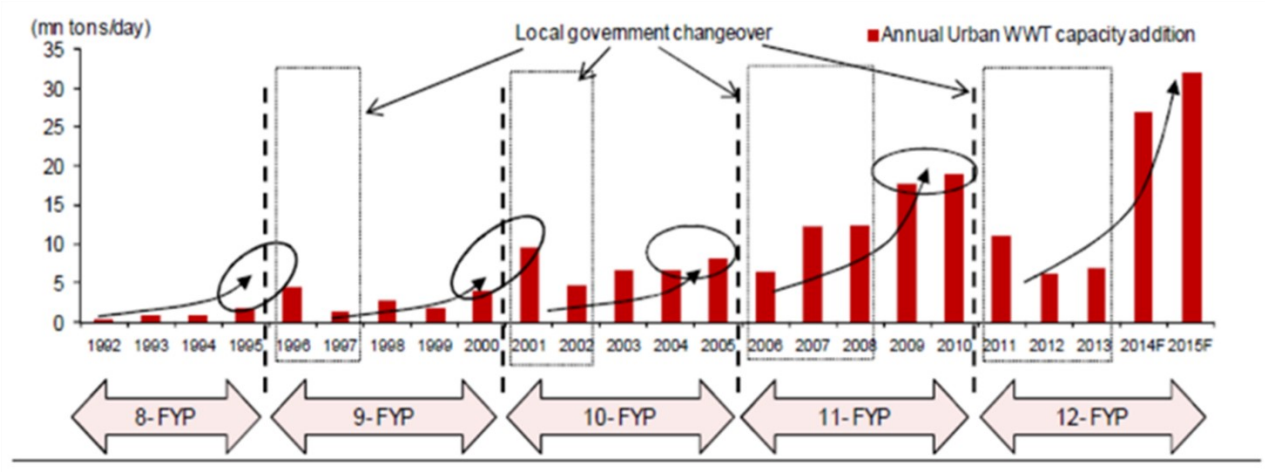
Chinese companies

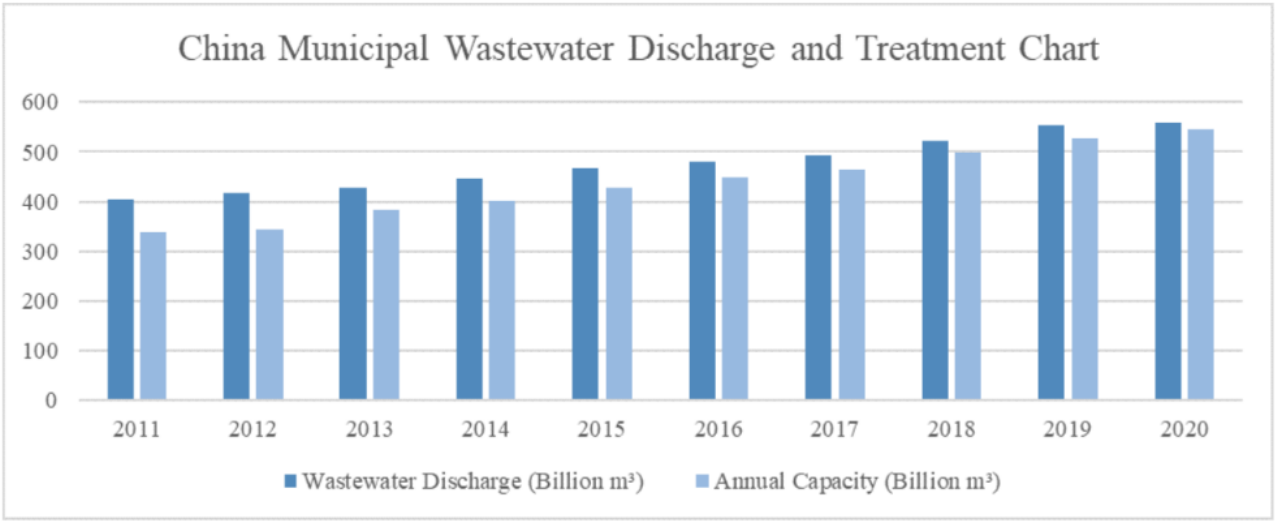
- Within which market segment could your market knowledge and relations be of high value to a European company considering to establish in China, hereby being potential partners in the market?

Market Drivers – regulatory steps in successive 5-Year plans

The Chinese Market for Water Technology has seen a steady growth for several decades, in particular following the increasing number of regulatory steps launched by the 10th and 11th 5-Year Plan, and speeding up following the 12th and 13th 5-Year Plans. In particular, this is obvious by the wastewater treatment (WWT) capacity added within each 5-year plan as shown in the figures below.

Regulatory steps as a key driver for market growth





China Municipal Wastewater Discharge and Treatment Chart 2011 - 2020

Source: China Ministry of Ecology and Environment

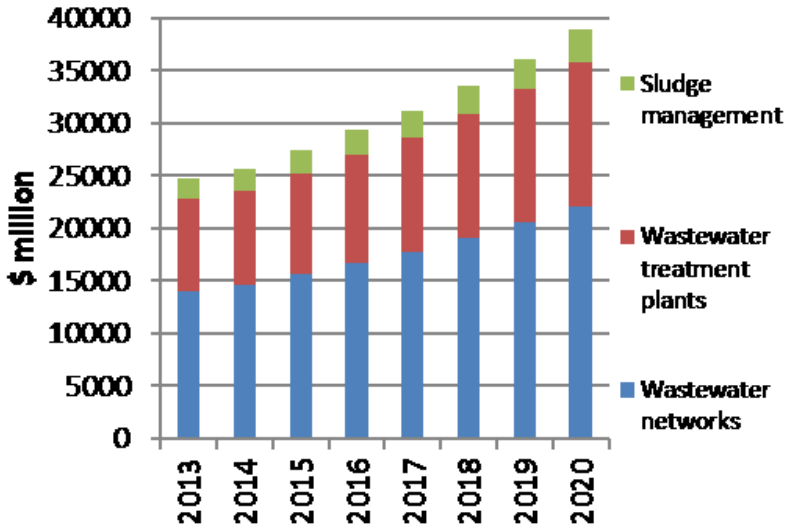
In in the 13th 5-Year Plan, covering 2015-2020, the main targets were

- Upgrade of municipal wastewater treatment
- New wastewater capacity
- Sludge management

- Wastewater reuse
- Installation of centralized wastewater treatment plants in all industrial parks
- All industries must meet the discharge standards in the 13th plan
- Cities to meet "Sponge Cities" Standards

According to China Water Risk, these targets were all reached within the scheduled time horizon!

The relation between the regulatory steps and market growth is clear from the figure:



Turning to the 14th 5YP, however, despite a continuation of the strong green profile of the overall development in China, hereby walking its talk of "ecological civilization" – of 8 binding targets, 5 are green and 0 related to economic growth - continued growth in the total, installed WWT capacity is not foreseen by Global Water Intelligence, which reported:

China unveils its new five-year wastewater roadmap

China this week set a dramatically lower target of 20 million m³/d of additional wastewater treatment capacity to be built over the next five years.

The number is less than half the previous five-year goal of 50.22 million m³/d, reflecting the country's remarkable progress towards universalising services (municipal wastewater treatment coverage grew substantially from 32% in 1999 to 96% in 2019).

Earlier this year, China published new guidelines for wastewater reuse, raising the proportion of sewage which must be treated to reuse standards to 25% by 2025. This offers further evidence of the country's ambition to transition from capacity expansion to a greater emphasis on treated effluent quality. As part of the effort, China also aims to construct and upgrade 80,000km of wastewater collection pipelines over the next five years.

Further, Global Water Intelligence has summarized the outlook regarding industrial water as follows:

China's renewed push for industrial water savings

The State Council of China's general plan for energy conservation and emissions reductions – released earlier this week as part of the 14th five-year plan (2021-2025) – sets the stage for further optimisation in the field of industrial water.

The plan calls for the country's energy consumption per unit of GDP to drop 13.5% by 2025 versus 2020, and for an 8% reduction in chemical oxygen demand and ammonia in wastewater by 2025.

Key industrial sectors, such as iron & steel and petrochemicals, are required to undertake energy-saving measures and raise wastewater resource recovery rates, with the aim of further reducing the volume of water consumed for every RMB10,000 of industrial value added by 16%, from 32.9m^3 in 2020 to 27.6m^3 in 2025.

In 2020, China's total water consumption reached 581.29 billion m^3, a decrease of 20.83 billion m^3 versus 2019. Around 90% of the reduction was due to industrial water savings

More details will be unveiled in two water-specific 14th five-year plans (2021-2025), which are expected to be issued by mid-2022.

- Out of 8 binding targets, 5 are green – 0 are economic
- Increasing focus on reuse of wastewater, water quality
- Further investments in wastewater, huge market growth

Green Ecology	Reduction in energy consumption per unit of GDP (%)	--	--	[13.5]	Binding
	Reduction of carbon dioxide emissions per unit of GDP(%)	--	--	[18]	Binding
	Share of days with good air quality in cities at prefecture level and above (%)	87	87.5		Binding
	Share of surface water at or better than class III (%)	83.4	85		Binding
	Forest coverage rate (%)	23.2*	24.1		Binding
Security/ Safety	Comprehensive grain production capacity			>650mn. tons	Binding
	Comprehensive energy production capacity			>4.6bn. tons of coal equivalent	Binding

China Water Risk summarizes the green profile of the 14th 5-Year Plan as follows:

Environment-first target setting: No GDP growth rate target in 14FYP but the majority of the binding targets are all environmental

It is worth noting here that out of all the 20 KPI targets set in the 14FYP, there are only 8 binding targets. Of the 8 binding targets – 5 pertain to "green ecology".

While there was a binding water pollution target (85% of surface water must be better than Grade III), there were NO GDP targets – either absolute nor growth rates – indicated in the 14FYP KPIs for 2025. It just notes re GDP growth: *"Keep it within reasonable interval, each year depends on the situation".*

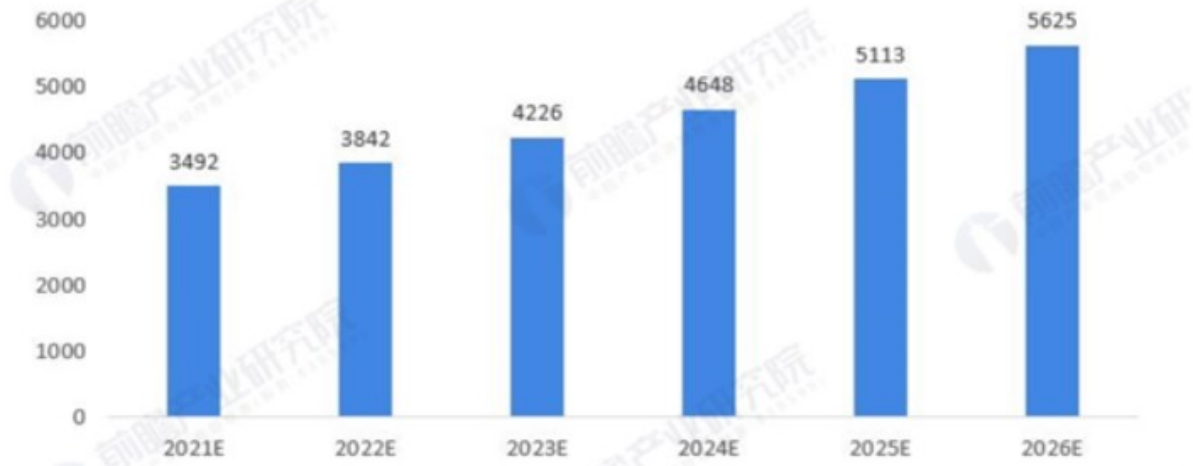
No GDP targets set & 5/8 binding targets pertain to "green ecology", one of which is water

Here it is also worth noting that none of the three economic KPIs were binding. So, are we finally convinced that China is prioritising the environment over growth? Anyway, whether you believe it or not, this sends out clear signals that meeting environmental targets in the 14FYP is key.

Indeed, this bias to the environmental vs economic targets was also the case in the 13FYP where despite tough challenges, China still managed to reach all the nine mandatory environmental protection targets by the end of 2020.

According to the report, Analysis of the Current Situation and Development trend of China's Water Industry Market (abstract of the report, in Chinese, can be found at https://www.qianzhan.com/analyst/detail/220/210802-5abeea82.html), which is made by Qianzhan Industry Research Institute (https://bg.qianzhan.com/), one of the Chinese most influential and authoritative research institute, the water market will keep steady growth with the support of national policies, and the growth rate will be 10% during the 14th Five-Year Plan period (2021-2025), and in the year 2026 the sales volume of the water companies will achieve 562.5 billion CNY.

图表5：2021-2026年中国规模以上水务企业销售收入预测(单位：亿元)



资料来源：前瞻产业研究院整理　　@前瞻经济学人APP

14th 5-year plan for water security- released January 2022:

Further promote industrial water saving and emission reduction

Increase the intensity of industrial water-saving transformation. Improve the water supply metering system and online monitoring system to strengthen production water management. Vigorously promote efficient cooling, washing, recycling water, wastewater-saving processes and technologies such as sewage recycling and replacement of high-water-consuming production processes, etc., support enterprises carry out water balance test, water-saving technological transformation and reclaimed water reuse transformation, and encourage enterprises to carry out water audit and water efficiency benchmarking meet the standards, promote the recycling of industrial water within the enterprise, and improve the reuse rate. Implement water-saving reforms for enterprises that exceed the water quota standard in stages and within a time limit.

Promote comprehensive control of groundwater overexploitation

On the basis of determining the water level control indicators for groundwater withdrawal, scientific and rational use of land water, and reduce the overexploitation of groundwater through water saving, agricultural structure adjustment, water source replacement, etc.
Increase water supply through multiple channels, and continue to promote comprehensive control of groundwater overexploitation. Overexploitation of groundwater in the northern region, reduce groundwater overexploitation, increase water supply through multiple channels, and speed up groundwater supply
Source replacement, implement groundwater replenishment in over-exploitation areas, and gradually achieve a balance between groundwater extraction and replenishment. Promote the control and protection of groundwater overexploitation in key areas.

Increase the utilization of unconventional water sources

Strengthen unconventional reclaimed water, seawater, rainwater, mine water and brackish water in water-scarce areas, diversified, cascaded and safe use of water. Taking sewage resource utilization as an important part of water saving and open source content, accelerate the promotion of urban domestic sewage, industrial wastewater, agricultural and rural sewage recycling.
Promote the integration of unconventional water into the unified allocation of water resources, increase the proportion of unconventional water utilization year by year, and establish an incentive assessment mechanism. Overall use of recycled water, rainwater, brackish water, etc., are used for agricultural irrigation and ecological landscape.
Give priority to unconventional water for ecological water use. Aim at the world's advanced technologies and support the research and development of unconventional water utilization technologies and applicable equipment.

By 2025:

The groundwater monitoring and management system has been basically established, and the overexploitation of groundwater across the country has been alleviated. The overexploitation of groundwater in key areas such as Beijing-Tianjin-Hebei and Northeast China has been effectively curbed.

Digitalization and monitoring:

Strengthen the construction of water safety monitoring system:

Taking the basin as a unit, improve the network of monitoring stations such as hydrology, water intake measurement and soil and water conservation system layout, implement the upgrade and upgrade of national basic hydrological stations, and promote the application of new monitoring methods. Expand the scope of real-time online monitoring, increase the density of monitoring station network layout, and improve gridding.

Strengthen dynamic monitoring of underwater topography in important reaches and sections of rivers. Intensive groundwater monitoring increase the density and monitoring of monitoring stations in key areas such as groundwater overexploitation areas and ecologically fragile areas.
Monitoring of water coastline, water surface area and other elements, in important rivers, lakes, drinking water sources development of automatic monitoring capacity building. Speed up on-line monitoring and metering facilities for water intake by water consumers above designated size Construction, and improve the monitoring capacity of water intake measurement.

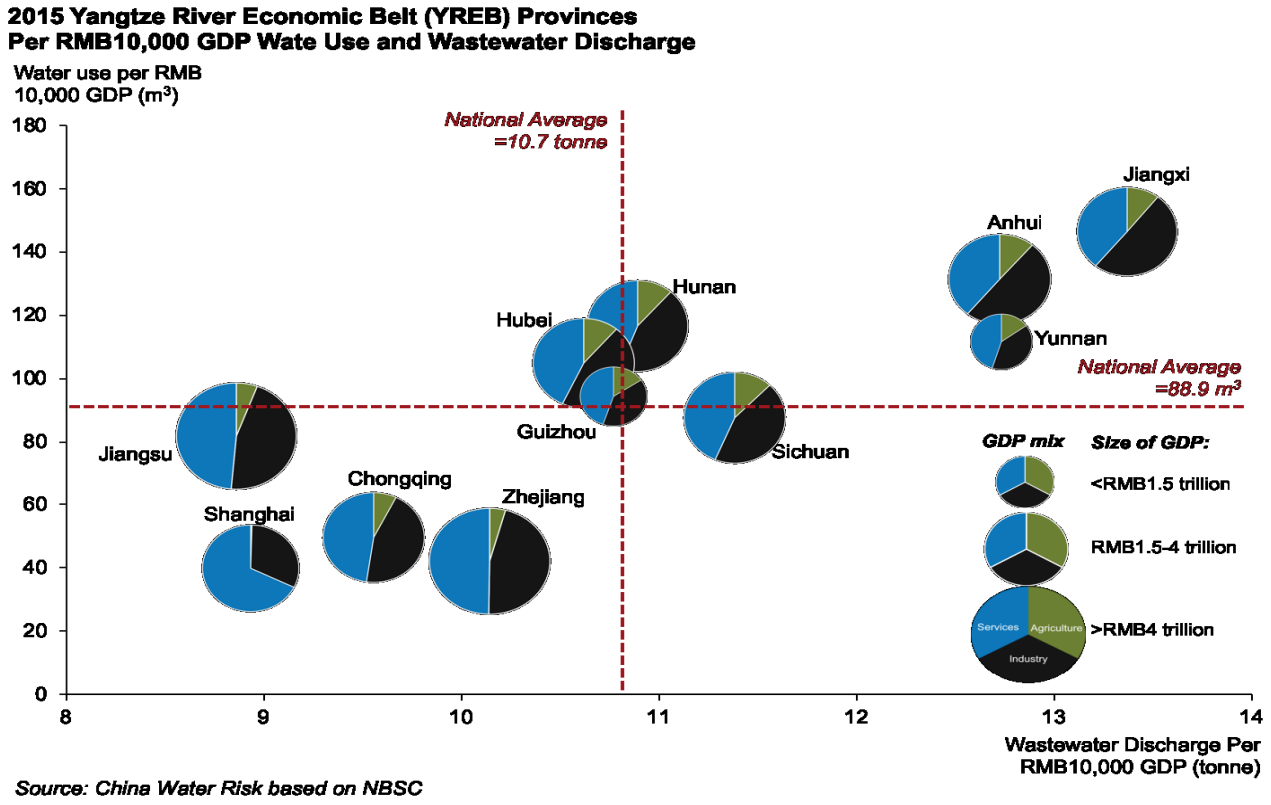
Strengthen the application of new monitoring methods. Make full use of high-resolution remote sensing satellites, radar, unmanned monitoring methods such as drones, unmanned ships, and underwater robots, and speed up the application of new technologies such as video and remote sensing.
Use innovation to improve the intelligent processing capability and business application level of remote sensing image data, speed up realize the full coverage of rivers and lakes, water conservancy projects, water conservancy management activities, etc.
Optimize and improve the water conservancy business network, water conservancy video consultation system, water conservancy blue letter and other infrastructure, strengthen the application of new-generation communication technologies such as 5G and Beidou satellites, and

expand a large-capacity, wide-coverage, and easy-to-maintain IoT communication network. Strengthen the security situation of water conservancy network.

Technology Demands

Inevitably, it is a substantial simplification to give a short and at the same time precise overview of which technologies are in high-end demand at the Chinese market seen from the stand of European companies.

First of all, China has to be seen as a continent of its own with "28 countries and 4 city-countries" each having its own characteristiques, challenges and local regulation. These differences are to some extent visualized in this figure elaborated by China Water Risk:



Source: China Water Risk based on NBSC

As an example of a market opportunity report specific about China Industrial Wastewater Policy Overview and Opportunities for EU SMEs in Qingdao & Chengdu Area, this report was elaborated for CEWP by the EU SME Centre in 2019: https://www.cewp.eu/sites/default/files/files/event%20files/Industrial%20Wastewater%20Report_(6th%20September%202019).pdf

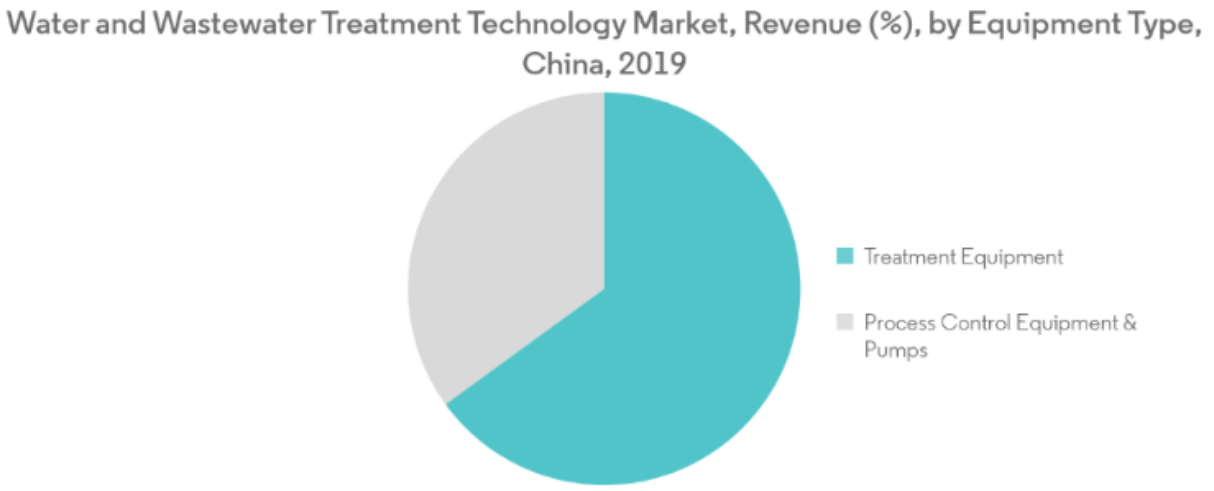
Bearing geographical specificities in mind, Mordor Intelligence in an overview of Key Market Trends in its 2021-2025 report list the following Treatment Equipment to Dominate the Market

- The oil/water separation equipment is widely used in the oil and gas industry to separate oil and water, followed by the processing of oil to produce downstream products. Oil and water treatment industries are the largest segments that require the usage of gravity separators and hydro cyclones.
- Suspended solids' removal is a primary treatment process for wastewater treatment, where suspended solids and floating materials are effectively removed. Effluent is passed through various stages, to remove materials, such as wood

pieces, plastic, paper, floating debris, metals, sand, clay, slit, ash, and other organic matter.

- Total dissolved solids (TDS) are the compounds left in the water after normal treatment and filtration. Drinking water contains hazardous chemicals from different water treatment plants. In such a situation, it is essential to use the proper filtration processes to remove the contaminants and make water safe for consumption.
- Biological treatment is an integral part of the wastewater treatment process. It treats the industry and municipality wastewater, which contains soluble organic impurities. This treatment technology uses organisms to breakdown the organic substances in wastewater, which includes the usage of nematodes, bacteria, and other small organisms.
- The high concentration of metals in water can affect plants, animals, and human beings, increasing the risk of skin and lung cancer, and possible effects on the nervous system. Thus, the elimination of these dissolved metals in industrial process water is imperative, before it is released or reused.

Owing to the aforementioned factors, treatment equipment is expected to dominate the market. Further, Mordor Intelligence draws up this market share division figure:



The PIANO project market report elaborated for CEWP in 2018 [check] listed the following market segments with potential for European companies:

- **Water Treatment:** rising standards, investment via PPP, mature market
- **Networks:** leakage detection, water quality monitoring, modelling

- **Desalination:** municipal market static, limited growth in last 5 years.
- **Wastewater Treatment:** rising standards, massive investment via PPP, mature market – integration to green infrastructure and ecology
- **Sludge Treatment:** Growing investment, developing regulatory framework, at take-off – integration to energy systems and solid waste management
- **Sponge Cities:** 16+14, moving beyond just pilots. The integration of Green infrastructure into urban planning and design was pioneered in Europe and is now being implemented on a massive scale in China

From the PIANO report made for CEWP, the following opportunities were concluded:

Industrial Water

- Clean Source: rising standards, investment via PPP, Mature market – Decentralised systems
- Reuse: Tightening regulation on water use efficiency. Developing infrastructure to market
- Wastewater Treatment: rising standards, massive investment via PPP, Mature market but much scope for further innovation.
- Coal to Chemicals – Massive scale, complex, ZLD requirement, 154 in Operation 69 in Construction (GWI)
- Industrial Parks
- Learn more: https://www.cewp.eu/sites/default/files/files/The-water-market-in-China.pdf

Market Outlook

Characterising the competitive landscape, Mordor Intelligence states that the China water & wastewater treatment technology market is moderately fragmented, with the major players occupying a low share of the market. Key players in the market studied include Beijing Capital Co. Ltd, BEWG, Suez, Veolia, and Aquatech International LLC, among others.

While listing some of the key players, Mordor Intelligence doesn't characterize the market as neither heavily consolidated with only a few leading companies, nor as a fragmented market being very competitive.

Other sources for an analysis of the key market players are Global Water Intelligence and Absolute Reports, all behind payment walls.

Market positioning and competition inevitably varies among market segments and geographical regions. The EU SME Centre summarizes the situation as follows:

- Only in niche and specialised areas can EU companies stand out. Major areas are blocked.
- SOE / Private sector companies are now fully established in the core markets. Little scope for EU business to directly engage in the main urban water business or to bid successfully against local players.
- Though it is rising, the low water price for water supplied and low rates for wastewater treatment provision remains a barrier to entry.
- The political means available to local companies to negotiate around low tariffs to get to extra payments is complex and sensitive and much more difficult to engage in for EU SMEs

Taking these observations regarding the market shares into account, both the Market and Technology Outlook sections as well as the findings from the CEWP events (summarized in subsequent sections) points to, that international companies with a clear niche, a considerate strategy as well as the necessary financial and manpower capacity and sufficient patience have great chances for doing very good business in China.

Having said this, certain trends and market barriers must be carefully studied, as outlined the following parts of the report.

Self-sufficiency and Pandemic:

The EU Chamber of Commerce China (EUCCC) in its position paper emphasises a number of market conditions in general terms, which in some sectors may constitute serious barriers, but not necessarily in the water sector.

During the Pandemic, Chinese companies have continued to develop their portfolios of products and services, including a strong focus on digitalization. The Pandemic has therefore, increased the competitive factors facing European companies.

With the prolongation of the Pandemic, this will be even more challenging during the coming years. For companies not established with permanent presence at the market, more than 3 years (2020-2021-

2022, as travels are currently not expected to ease until 2023) may have passed since their last visit to China.

In addition, the red thread of the 14th 5-Year Plan - Chinas capacity for self-sufficiency - may add to the challenges. The EUCCC Position Paper 2021-2022 pays quite large attention to this particular topic, where the Chinese Government from a strategic point of view, and in many ways a legitimate approach, seeks to ensure self-sufficiency rather than a heavy dependence on technologies from outside. Regrettably, this is in a number of cases within priority technologies, sought to happen via a market exclusion of international players. Although water technologies are not listed among the priority technologies of the *Made in China 2025* strategy document, the overall message with its very strong political character may inevitably trickle down to the water market as well, hereby at the end of the day hampering the technology transfer of state-of-the-art solutions from more advanced markets.

EU SME Centre advise to market newcomers

The EU SME Centre Beijing offers a number of services for European SMEs:

Specifically in connection with a market entry, the EU SME Centre lists a number of recommendations of newcomers to the Chinese Market:

- Understand the market and the procurement processes.
- Match to the needs and expectations of the clients.
- Map the revenue streams of the clients and the supply chain.
- Best chances of successful entry are in niche, emerging **or high-risk areas**.
- Keep the product simple. Express yourself in simple terms.
- Comply with local standards and market prices.
- Define a premium product that still offers good value.
- Have strategies to protect your IPR.
- Acquire knowledge of the financing options.
- Understand the reforms to the procurement regulations and the actions now available.

- Invest in building relationships with technical, business and financial partners and exercise due diligence.
- Who are the real clients and key partners and which actions need to be taken at which stage of the procurement process; from profile raising and intelligence gathering to positioning, partnering, tendering and the delivery of projects.
- these are likely to be quite different to typical European client expectations. This will mean doing research and listening very carefully to what potential clients are saying.
- make sure that you are entering the deal at a point at which clients have revenue available with which to pay you.
- If done successfully, it is possible to achieve very high margins in China – potentially higher margins than in the EU.
- Though the greatest skill that Europeans have is the ability to efficiently manage complex integrated systems, this can be very difficult to explain to Chinese clients. Therefore, express yourself in simple terms.

EUCCC Recommendations for European Companies

Also EUCCC lists a number of recommendations for European companies

- Continue to integrate foreign staff into China operations—as well as Chinese staff into global operations—in order to maintain diverse teams and avoid talent silos.
- Strengthen links between global and China teams, in order to both increase understanding of China among headquarters and develop coherent China strategies.
- Establish 'decoupling teams' to evaluate the costs associated with both localisation in China and disconnection from certain global systems.
- Develop a cost/benefit analysis of adopting either a 'flexible architecture' model that can be localised for different markets or a 'dual system' model that completely separates China production from production for the rest of the world.
- Audit all supply chains to determine the current and future level of exposure to sanctions.
- Adopt a realistic strategy for remaining abreast of, and reacting positively to, changes in markets, public opinion and governments that could have an impact on China operations.
- Avoid entering certain segments, or consider winding down certain business lines, that are exposed to existing or potential sanctions, whenever the costs outweigh the benefits.
- Develop flexible global corporate decarbonisation strategies that can be adjusted in the event that China operations are unable to access green sources of energy.
- Invest and participate more in government advocacy efforts through chambers of commerce, industry associations and standards-setting bodies.

CEWP Focus Market Segment 2019: Industrial water use - Conclusions and Perspectives

In 2019, CEWP hosted four Business and Innovation Program Events and prepared/identified a number of background documents /1-5/ on industrial water use with the aim of helping European Companies in getting access to the significant Chinese Market for Industrial Water Technologies and of facilitating establishment of innovation-oriented relation-building between Chinese and European experts.

The focus on Industrial Water Use started with two Information Meetings held in Qingdao on April 12th and at the IE Expo in Shanghai on April 15th with more than 200 participants from China and Europe, followed by the 14th EU-China EUPIC/EEN fair in Qingdao and Chengdu in November 11th-15th with more than 300 participants.

Conclusions

Based on the results of the activities it can be concluded that:

- Significant water scarcity hampers secure water supply to industries.
  Several industries are characterized by a potential to increase water use efficiency, among other due to weaker regulatory requirements and pricing of water and energy. Wastewater from industries has a potential to be further treated among other due to very basic regulations or lack of enforcement of regulations. Regulatory requirements- at national and provincial level however will increasingly be strengthened in the coming years

- Significant upgrade of regulatory requirements.
  A number of legal and regulatory instruments at national and provincial level will be fully enforced in the coming years like *Water Ten Action Plan* and *Made in China 2025* (*中国制造2025*), which stipulates that by 2025 the water consumption per unit of industrial value added should be 41% lower than in 2015, causing a rise in the demand for industrial wastewater treatment and recycling systems.[1] At provincial level water quota and water pollution standards are in the process of being strengthened.

- Industries faces significant policy risks.
  Regulations from water authorities only relates to water, while other factors as energy efficiency, energy pricing and resource efficiency (circular economy), as well as procurement and standards are left to other authorities to regulate. For industries this gives difficulties and uncertainties in predicting policy changes, by industries known as policy risks. This makes decisions on investments in cleaner and more resource-efficient technologies difficult. Future impacts from Climate change is likely to lead to increases of water and energy prices and likely implementation of smart electricity grids. This again will lead to increasing demands for energy-efficient water technologies. Altogether, the lack of cross-sector co-ordination leaves the industries with significant policy risks.

- Market focus on "Buy Cheap" prevents "Buy Clever".

[1] http://www.gov.cn/zhengce/content/2015-05/19/content_9784.htm,
http://english.www.gov.cn/policies/latest_releases/2015/04/16/content_281475090170164.htm

Currently, the Chinese water technology markets are primarily dominated by low CAPEX as the key competition factor. Inevitably, this leads to long-term relatively high OPEX costs and high reinvestment needs, especially in the context of increasing regulatory demands and increasing prices. Therefore, investments made following the low CAPEX approach may lead to low resilience to these changes and accordingly low long-term value.

- Digital Transformation is gaining momentum, but unevenly implemented.
  Digital transformation has enormous potential for both improved efficiency and effectiveness and the Chinese IT sector is seeing this potential. Authorities will gradually discover this and relate future regulatory requirements to these possibilities for improving the environmental situation. For industrial production as well as wastewater treatment, digital transformation will offer substantial opportunities for improved management of production, activities and asset management. Similarly, wastewater treatment plants will see significant opportunities following digital transformation.

- Tenders for B2G doesn't promote Technologies for the Future.
  In many cases, current tenders may not reflect these upcoming changes, rather they are based on the solutions of yesterday. Tenders should be made in co-operation with business partners, who are fully updated about the upcoming changes and opportunities – consultancy companies. It is questionable whether today's Design Institute can fulfill this role. Lack of Financing constitutes a serious barrier for procurements focusing on long-term value.

- Overall Conclusion: Current Market Functioning leads to short-term focus.
  As a final conclusion the Chinese industrial water market can be considered quite conservative and driven mainly by regulatory requirement. Demands for low cost technologies, which can comply with the regulatory requirements and only to a limited extent by costs of resources (in particular water and energy), dominates the market requests.

Perspectives for business and innovation

The Events identified niches where European Companies may get access to the significant Chinese Market for Industrial Water Technologies. Some niches are already there today and others will develop with stronger regulation as well as increasing resource prices. In the following, the short term and more long-term perspectives for European companies in the Chinese market are listed:

Short term perspectives and niche-market opportunities

- Water conservation, reclamation, water reuse and recirculation driven both by national and provincial level regulations. The market demands technologies both for local industrial water reclamation and reuse within the industry itself and in larger water reclamation schemes. There may be a niche here for decentralized reclamation schemes and technologies, as large centralized systems are expensive due to the high piping costs.

- Industrial water pollution control in particular in Industrial parks. China is relocating many of its industries like chemical and pharmaceutical industries into parks with the same type of industries. While the present regulation is quite basic there may be strengthened regulation of wastewater discharge also including specific hazardous chemicals.

- Pre-treatment of industrial wastewater discharged to municipal wastewater systems could be another niche. Heavy metals and hazardous chemicals end up in municipal sludge and prevents the reuse of sludge as fertilizer in agriculture- a procedure which is practices in many European countries.

- Digital transformation has enormous potential both for improving efficiency and effectiveness and the Chinese IT sector is seeing this potential, implying technology transfer into the industrial water market, aiming on one hand to document compliance with regulations in a longer perspective also in reducing production costs and reuse resources within the industrial plant site.

- To be successful, EU Companies will have to find the niches in which their expertise and premium technology are valued and there are clients with the financial resources to procure their services. If companies are doing it right, the opportunities will outweigh the challenges. Such niches could be energy optimised sludge and wastewater treatment, resource reuse and industrial parks water and wastewater technology and resource use.

- Doing it right means in selected niches requires and understanding of who the real clients and key partners are and which actions need to be taken at which stage of the procurement process; from profile raising and intelligence gathering to positioning, partnering, tendering and the delivery of projects

Long time perspectives

- Climate change and increasing resource costs and circular economy will have a large impact on a future industrial water market in China. European Companies will have an advantage as these drivers in addition to strong regulation are increasingly driving the European market today. CEWP events provides a forum for dialogue on how these drivers may also in the future drive the Chinese market including the regulatory requirements, management procedures and new technologies needed. Maintaining and extending the dialogue between China and Europe on this topic seem crucial for the development of these future markets and for Chinese water management.

For more information, pls visit:
https://www.cewp.eu/sites/default/files/files/Final%20Draft%20Report%20from%20EU%20China%20Water%20Developmner%20Forums%20in%20Chengdu%20and%20Qingdao%20November.pdf.

CEWP Focus Market Segment 2020-2021: Urban water - Conclusions and Perspectives

The Urban Water Webinar Series organized by the CEWP Business Program during 1st half of 2021 concluded that challenges facing the Water Sector could to a large extent be addressed, if already existing technical solutions and services were fully utilized. Needs for technological innovation still exists, with the main needs being systemic innovation improving sector integration and allowing for a holistic approach to the full water cycle, e.g. in order to facilitate increased reuse of water.

In addition, state-of-the-art solutions offers stronger resilience to climate change and a better take-up of the potential related to digitalization and circular economy. Digitalization will allow for significant larger amounts of data to be analyzed, hereby de facto leading to actual realization of the intentions behind various concepts about integrated approached developed within the water sector during recent decades. Circular economy-based solutions will in particular imply a stronger integration of water and energy, hereby leading to new business models to be developed.

While state-of-the-art solutions are in general costlier, they have a significantly better Operational and Maintenance costs profile, whereas bulk solutions using simpler technologies are cheaper to procure. However, a.o. due to lack of adequate financing models, economic frameworks promoting long-term sustainability as well as inadequate regulatory frameworks, the cheaper solutions are preferred during a majority of most tender processes. Further, lack of pricing based on true costs of water and energy, as well as total cost of ownership, also adds to the picture of inefficient use of funds in the water sector.

Introduction:

The aim of the CEWP Business Program is to contribute to creation of a well-functioning market, defined as delivering the solutions, which enables government targets to be achieved to be achieved in the most cost-efficient ways to society. The CEWP program therefore facilitates technical discussions but also shed light on efficiency gaps of the market.

In total, four webinars constituted the full series. They were followed by an aggregate of more than *300 participants from 20 countries*, mostly but not only China and European countries, explored the management of the Urban Water Cycle in Europe and China. The webinars presented experiences and case studies and discussed various aspects of Urban Water Management including: blue-green and sponge cities, efficiency of water infrastructure, digitalization and water sector carbon footprint[2]. The webinar series were followed up by a physical event at Aquatech Shanghai in June 2021 as well as a presentation given by the EU SME Centre at the business exchange meeting at Water Expo China in Wuhan also in June 2021.

The *Setting the Scene speeches* as well as the *Company Technology presentations* referred to the following main drivers: *climate change, increased water demand from urbanization and industrialization, and pollution due to inadequate wastewater treatment and inefficient enforcement*. The main enablers referred to were: *digitalization and circular economy inspired solutions*.

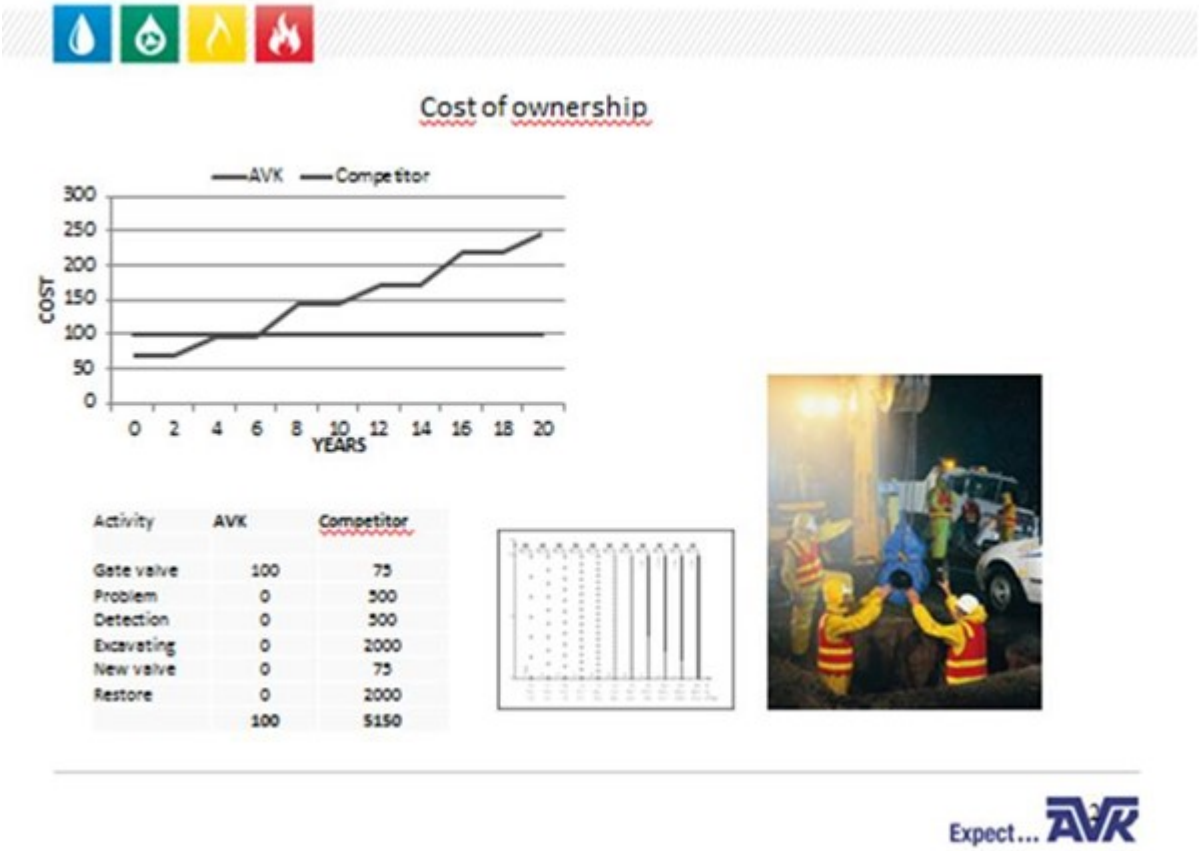
In particular, the link between water and energy solutions were central to most webinars. The present discussion report builds on the webinar reports and *take away messages* from the roundtables, the chair and rapporteurs' observations of the key results of the webinars as well as good experiences presented

[2] Presentations, recordings of the webinars and webinar reports can be found at https://www.cewp.eu/waterurban

by the speakers of the webinars. The roundtables organized in each webinar focused on the framework conditions, which would be necessary to implement the technologies available, and forms the basis for the recommendations presented in this report.

Another main conclusion was the market functioning, which besides a few cases involving large players with capacity to independently establish their own long-term perspective on the market and technology perspectives of, say, 2030, indicated serious efficiency gaps between national, environmental and water security targets and adjoined budget allocations, and the actual market transactions via tenders.

Eg. the market functioning overall doesn't support long-term economic efficiency, resilience to climate change, cross-sector perspectives notably energy use efficiency or update of digitalization.



A third, main finding relates to the "Sponge City Market", where mechanisms to ensure the technical findings of Lot 3 CeCoSC – that optimal long-term value creation to society needs combinations of so-called 3PA and BGI and synergies with other sectors - to be retained at "the market". In other words, that this overall, cross-sector approach is retained when "translating" urban planning and investment schemes of this field into individual, budget expenditures. And also to allow for exchange of international experiences by involving international consultants during the initial stages – screening, scoping, strategy and priority setting, public planning and eventually investment schemes.

In the following, the main observation points regarding the two prominent enablers, digitalization and circular economy are presented.

Observations on digitalization.

China and Europe are both aiming at developing new digitalization solutions to improve the efficiency of their urban water management, however in different contexts. Overall, Chinese cities sees increasing urbanization (with the 14th 5 Year Plan setting a target for 2025 of 65% compared to todays' 61%) and construction of new, urban areas, compared to a stronger focus on retrofitting existing urban areas in Europe.

Digitalization in the water sector has a big potential and digital water technology is largely already available and the water sector is already using it and benefitting from digital transformation. To get the full benefit of digitalization, a focus on human interaction with technology is still very important and training is needed for those who work with and operate the technology. To many people in the water sector, digitalization is still approached using an "analog" mindset, aiming at optimizing water management, rather than using a "digital" mindset with the aim to transform water management.

Digitalization has entered all water subsectors, including water quality and water quantity management in water supply and waste water systems, leak detection, flood management and early warning, irrigation systems and catchment management.

Digitalization technology is fast developing at all stages of the water management cycle including monitoring and metering systems of data, data collection systems, data management systems and intelligent information systems.

Availability of sensors with a potential for real time monitoring is essential for fast management response both in e.g. flash flood early warning and management and in water quality and quantity protection and management. However, sensors (or other monitoring equipment) able to detect advanced, chemical parameters in real-time on-line are in most cases still to be innovated.

*Digital solutions will challenge the existence of silo´*s and current institutions set-up in urban water management. With increasing ability to perform *data crunching* at an unprecedented scale, the current institutional and geographical boundaries will increasingly constitute a barrier for efficient solutions. Vested interests in existing structures will be a special element to adress. Of particular importance is the connection of the silos for water supply and waste water treatment and the integration among decision makers.

Procurement of digital water solutions may not be well specified in tenders. ISO 55000 and other related standards can be used to make the demand/requirements for the IT water solutions more precise. This is particular important in multi-stakeholder water management systems like e.g. catchment system with many different management needs.

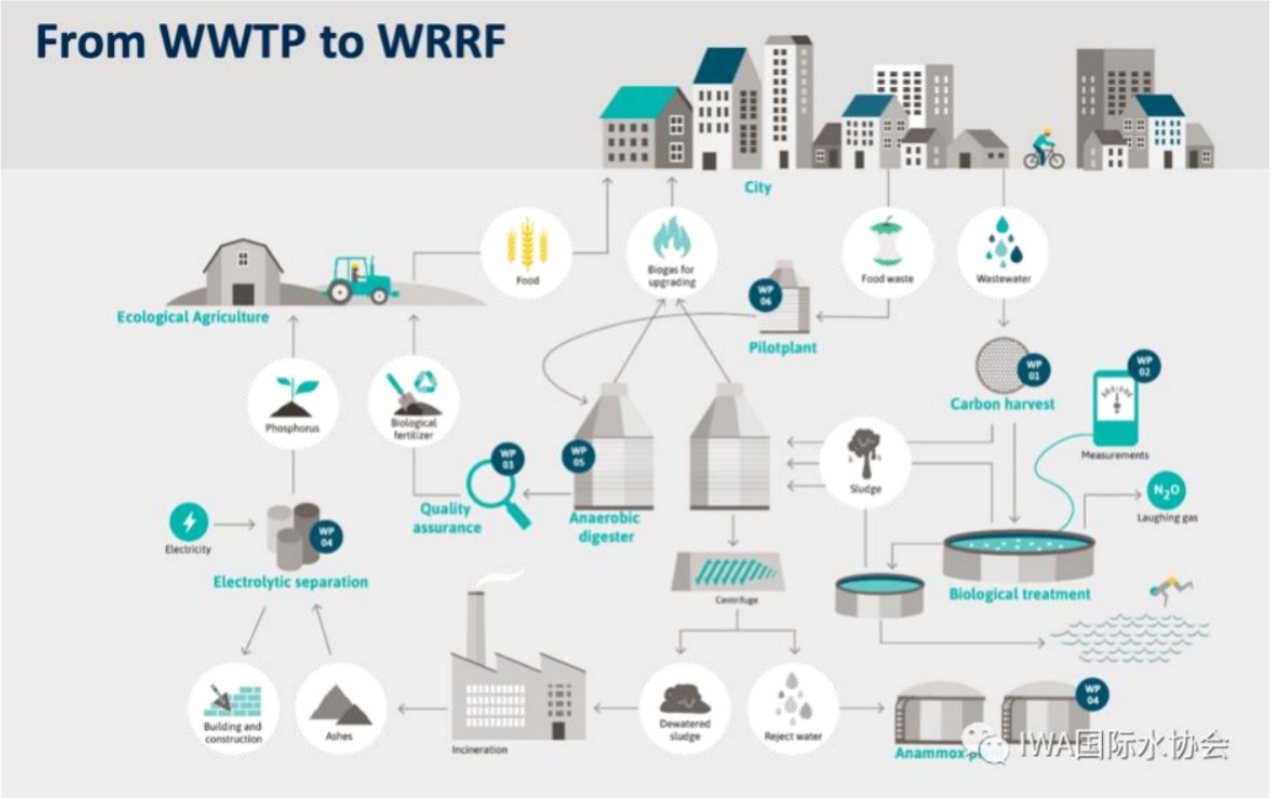
Observations on circular economy.

Circular Economy has become prominent in both European and Chinese policymaking. Chinese and European perspectives on a circular economy share a common conceptual basis and exhibit many similar concerns in seeking to enhance resource efficiency. The Chinese perspective on the circular economy is broad, incorporating pollution and other issues alongside waste and resource concerns, and it is framed as a response to the environmental challenges created by rapid growth and industrialization. In contrast, Europe's conception of the CE primarily has an environmental scope, focusing more narrowly on waste and resources, and opportunities.

In Europe circular economy approaches are also emerging as an approach to reduce the emission of CHG´s. Globally 4% of all electricity is used in the water sector to supply water for human

consumption, food and industrial production and waste water treatment. An increased efficiency of the urban water cycle will make more water available but also reduce the emissions of CHG´s and make more resources in waste water available for reuse.

Trends in Europe are towards integrated water and waste water systems, reduction of energy use and CHG emissions per volume of water managed and an emerging integration of water and energy systems. In China energy use and CHG emissions per volume of water managed has been increasing due to a.o. more extended treatment. The potential to reduce the CHG emission and the recovery of resources is considered to be significant, although validated are not available. Estimates ranges from a few percentages up 10 percent.



Circular economy-based solutions in the water sector have a big potential and technologies are largely already available and the benefits in terms of water and resource savings and reduction of CHG´s has been demonstrated in many countries including Europe. Key elements of reducing the carbon footprint and saving resources in waste water treatment systems are: Increased process control, variable operation of pumps etc. depending of the load, carbon harvesting for biogas production, deep process control and knowledge and combined heat and power installations and can even make waste water treatment and water supply systems energy-positive.

A move from the concept of Waste water treatment Plants to Water Resource Recovery Factories to save resources has been promoted primarily in research and demonstration projects, however is increasingly emerging as a new concept in advanced larger water organizations.

Circular economy solutions are increasingly supported by digitalization technology including monitoring and metering systems of data, data collection systems, data management systems and intelligent information systems.

Integrated water and energy and resource reuse systems increase the outcome of Circular economy solutions and may reduce the impact of the existence of Silo´s among institutions involved in urban water and energy management. Of particular importance is the connection of the silos for water supply and waste water treatment and the integration among decision makers. In these sectors.

Procurement of water and energy solutions may not be well specified in tenders. standards can be used to make the demand/requirements for the solutions more precise. This is particular important in multistakeholder water management systems like e.g. catchment system with many different management needs.

Water supply and waste water treatment organizations are natural monopolies and may need incentives and/or regulations/goals from regulatory bodies to take actions in investing in reduction of carbon footprint and recovery of resources.

Investments in Energy savings, energy production from biogas and utilization of water borne energy may in some cases have short pay- back time. Ring-fencing the economy of water and waste water organizations is a necessary condition for keeping the savings in their own organization. Also, in case a waste water treatment plan can be made energy positive, it should possible for water organizations to sell/provide their energy surplus to the energy network or other energy users.

In ceonnection with the webinar on Carbon Footprint, two background reports were made:

Circular Economy in the Wastewater Sector

https://www.cewp.eu/sites/default/files/2021-05/CEWP_Whitepaper_Circular%20Economy%20of%20Water%20in%20Waste%20Water%20Treatment_final.pdf

China Carbon Neutrality 2030/2060 in the Water Sector

https://www.cewp.eu/sites/default/files/2021-05/China%20WW%20carbon%20neutrality%203060%20path%20and%20solution%20report_NORDIQ0428.pdf

Main findings from the events:

- Digitalisation brings up the importance of breaking down the silos which has been addressed multiple times – both from a regulatory framework point of view and from a customer point of view
- More untapped opportunities will request an organizational change that digitalisation could possibly bring
- The conceptual move from WWTP to Water resources recovery factories has been not only promoted primarily in research & demo projects, but also in advanced larger scale water organisations.
- The implementation and stage execution of the environmental focuses of the 14 FYP is key to reaching several government targets.
- In both seminars, the Setting the Scene speeches as well as the Company Technology presentations used the same main drivers of climate change, increased water demand from

urbanization and industrialization, and pollution due to inadequate wastewater treatment and inefficient enforcement as main references for the challenges facing the water sector.

From the exhibition @Aquatech Shanghai:

- Technologies from the Chinese exhibitors are catching up, particularly in smart water management. The solutions provided by Chinese companies can be more accurately providing an answer to the local demands.
- Some Chinese exhibitors (water purification systems, membrane, Water pumps) are eager to seek for exporting opportunities.

Conclusion drawn:

The urban water management webinars supported the observations made in other CEWP seminars and workshops that challenges facing the Water Sector could to a very large extent be addressed, if already existing solutions were fully utilized. Needs for technological innovation still exists. However, the main needs are for systemic innovation improving sector integration allowing for water supply and wastewater management to be monitored, analyzed, planned and managed by the same organizations, e.g. in order to facilitate increased reuse of water.

While state-of-the-art solutions are in general more costly, they have a significantly better O&M cost profile, whereas bulk solutions using simpler technologies are cheaper to procure. However, due to lack of adequate financing models, economic frameworks promoting long-term sustainability as well as inadequate regulatory frameworks, the cheaper solutions are preferred. Further, lack of full pricing based on true costs of ownership, also adds to the picture.

For more information, pls visit: https://www.cewp.eu/sites/default/files/2021-11/CEWP%20Webinar%20Series%202021%20Draft%20Consolidated%20Report%201406211%20HEDIS.pdf

CEWP Focus Market Segment 2022: Rural water – Scheduled activities

In 2022, Rural Water will be the priority market segment, including the following topics at a series of webinars, March-May 2022:

March 29th
River Basin Management, Digitalization, Water Quality Monitoring and Equipment, Wetlands, Lakes and Rivers Restauration, Flood Protection (With Lot 1)

April 19th
Small-scale Water Supply and Wastewater, Water Networks and Wastewater treatment (Decentral Management, Small Scale Solutions) in rural areas, smaller cities (Tier 4 and lower levels), including Biological Wastewater Solutions and Recycling Wastewater for Rural Cities and Villages (With Lot 2)

May 10th
Groundwater Management, Reducing surface and groundwater water pollution, Groundwater Extraction, Monitoring, Protection against overdraft (With Lot 2)

A Side-event, @Aquatech Shanghai 2022, may be held, depending on Corona situation. Also, a Side-event @IWA World Congress Copenhagen, September 11th-15th, 2022, will be held, summarizing the outcome of the Business Program 2019-2022.

A side-event, @Annual High-Level Meeting, Europe, 3rd Quarter 2022, will be held focusing on Agricultural Water Use: Irrigation, Nutrient management and budgeting; Irrigation, including water technologies for the Food Sector including Agriculture.

Draft Policy Recommendations

The Value Chain of the Water Sector can in a simplified version be presented as follows:

Drivers - Investments - Procurements - Operations - Monitoring

For each step, there is a risk of initiatives loosing efficiency (costs of initiating an initiative are relatively high), effectiveness (initiatives not leading to a result) or efficacy (the results of an initiative doesn't deliver the right result).

In the context of the CEWP Business and Technology program, our activities and analysis at their core looks into if current market functioning actually deliver the anticipated targets, and at which costs, and if the market allows for cost-efficient state-of-the-art solutions with huge resilience to future change eg. climate change are actually available at the market.

Without these being in place, investments may risk being without adequate efficacy or having low cost-effect ration, in other words it is very expensive to achieve the desired results.

Drivers may be Public Target Setting eg. via 5-Year Plans, Profit-driven decisions of private stakeholders eg. industries and utilities emphasizing Asset Management, or new technologies, eg. digitalization. Also, energy prices reflecting true cost of operations as well as an internalization of external, undesirable effects, eg. climate change, has proven to have the potential of seriously driving change in the water sector. In China, as documented in this report, the 5-Year Plans constitute a very significant regulatory driver for the water sector.

Investments in the water sector typically originates from Government budgets, utilities or private sector. They follow different structural ways, in some cases the investor and the one actually spending the more is the same, eg. in industries, while in other cases, especially related to government budgets, the funds are distributed across eg. provinces, cities or utilities depending on the concrete case. In any case, some sort of procurement, i.e. interaction between the investor (customer) and the supplier takes place.

Procurements at a "market" is the transaction stage, where the funds of the investor is changed into some sort of solution, which could be advisory services, hardware or software. The market could bevia a direct providing of solutions without any competition, or via an open competition. In the water sector, this is often via bidding procedures following certain rules. Importantly, at this stage the demands of the investor initially formulated in terms of targets is translated into a requirements specification based on one or several standards. Exactly this process of formulating the specifications constitute a stage, where the efficacy may lose value, eg. if the standards hasn't been revised according to either public policies or availability of state-of-the-art technologies, or if the standards only relates to a given sector, not taking into account eg. energy efficiency of water technologies.

Operations

Following procurements of any type of solutions, it is important to look into the use of these at the operational stage. Here, effectiveness of the investments may be reduced substantially, eg. if the competences of the staff of the operator are not sufficient, e.g. when procuding digital solutions without having digital competences at all relevant levels of the organization. Other examples include lack of incentives for the organization to effectively apply the solutions, eg. if economic incentives of a utility doesn't reward a utility to make full use of equipment related to reduction of non-revenue water (water leakage), due to that the utility itself are not allowed to keep increased incomes. Globally, it

constitute a huge efficacy problem, if utilities don't have the right incentivized framework conditions in terms of a ring-fenced economy and the ability to get pricing right. Particularly important to mention is the importance of getting pricing right: energy costs have the potential to be a key driver for efficacy in the water sector, but this is lost if prices are substituted. Also, seriously important for having a strong value chain is the ability of a utility to implement a true-cost-of-ownership approach in its economic operations. This may be a key reason for not building sufficient interest on the operator side to procure state-of-the-art solutions with low, long term operational costs compared to the cost profile of bulk solutions.

Monitoring

At the end of the day, not monitoring market efficiency and effectiveness of investments and initiatives implies a huge risk of budget resources spend not leading to a desirable effect profile to the investor. To public money spend this means long-term costs being unnecessarily high.

In the following, a number of Draft Policy Recommendations are presented. These are intended to be presented to the CEWP Annual High-level Meeting in 2022:

#1 Improve Technology Transfer to support Green Transition

Use of new solutions are essential to facilitate the Green Transition. Technology Transfers from other sectors and other markets constitute a proven road to a successful Green Transition. During these years, technology transfer from other sectors regarding digitalization holds huge potential for improving operational efficiency. However, developing new solutions requires investments form public or private sources. For private companies to invest in solutions for the water sector, reducing policy risks are extremely important. Policy Risks are especially related to uncertainties about when Public Authorities will imply specific regulations, hereby also changing the market playing field. For the Chinese Market, the long-term practices embedded in 5-Year Plan is a strong tool for reducing policy risks, if this is also translated into upgrading standards used for design of tenders accordingly. Without ao. such changes, the market will still request bulk solutions instead of the costlier, but much more effective state-of-the-art solutions.

A suggestion could be to select technologies / market segments are of particular importance and carry out a "service check" of the entire value chain.

Technology transfer from other markets, in other words, access of international companies with relevant technologies to the Chinese market is essential. Beginning with challenges related to language difference, EUCCC in its annual Position Paper (latest version covering 2021/2022) documents a number of market barriers for international companies established or considering to establish in China. Some years back, IP-fraud constituted a significant problem, however this has now ceased due to important changes in the legal framework and court system. Among current challenges for companies considering to establish in China, the requirement of having documented proof-of-technology cases from within China constitute a significant barrier. Also highly important to mention is the important role played by standards used for designing requirements specifications used in bidding rounds.

Also for this topic, a "service check" of the actual content of key standards should be examined, both for the technological requirements related to the water sector, but especially also requirements related to the energy efficiency of the products.

#2 Increase Public Value Creation from investments in Water Sector

Next to the impact of the "Market Functioning" on which type of products are procured following bidding rounds, and which companies actually has access to the market, as outlined in Policy Recommendation #1, it is of outmost importance for Public Value Creation from investments in Water Sector to follow to which extent the procured solutions are used in an efficient manner.

Especially to factors may decrease the public value of investments: lack of competences in the organization of the operator and lack of economic incentives to prioritize efficient use of the procured technologies.

Lack of competences could eg. be within digitalization. Efficient used of digital solutions requires adequate competences of the staff to ensure efficient use. A "Technology Fix" approach to addressing problems via procurement of new solutions, which sounds good, but takes place without sufficient assesments of the assumptions for effective use of the technologies, may easily result in decrease of public value of the investment. This is typically happening in operational contexts, where the economic incentives framework for the operator isn't established in a comprehensive manner.

A suggestion could be to review this framework for the public operators undertaking procurement of new technologies.

Lack of economic incentives to prioritize efficient use of the procured technologies relates to the operators not having sufficient internal pressure, strategy or competences to make full use of procured technologies. An example is water leakage, which can often, and very surprisingly, be found an areas with severe water scarcity. The reason that water leakage of 20-70% (global cases) can be found in the lack of economic incentives for the utilities responsible for water supply. Some time, they have stronger incentives for addressing water supply by increasing the water resources brought to the system, instead of reducing water leakage – which is the "resource-related name" for the term non-revenue water, which is the "utility economy name". In the situation, where the utility doesn't have a "ring-fenced economy" allowing it both to define the prices, but also to retain the income generated from turning unpaid water losses eg. illegal tapping into revenue streams, the consequence is often neglect of water leakages. Another aspect of the lack of a ring-fenced economy is often the neglect of long-term economic costs of operations, which as a consequence has the lack of interest in economically efficient technologies. Again a structural reason for lack of interest in state-of-the-art technologies, which are typically more expensive to procure, but with much less long-term operational costs.

A suggestion could be to review the incentives structures and operational framework conditions for utilities and other water sector operators seen in the context of securing long-term sustainability, both environmental and economic.

#3 Reduce Carbon Footprint of the Water Sector

The Carbon Footprint of the Water Sector is a factor often not addressed by the sector itself, however it may add up to a substantial amount of greenhouse gas emission contributing to climate change, and in turn to worsening the challenges within the water sector, in particular water scarcity and floods following cloudbursts. Climate Change Adaptation, especially Sponge City programs, progresses quite well, but regrettably, however, the water sector itself has not turned a reduction of its footprint into a systematic approach covering all parts of its value chain. The energy use of the sector, in particular via electricity use, is estimated to be at the scale of 2-10% of the total, national electricity consumption. This originates both from the water supply and the wastewater management side of the water cycle.

On the Water Supply side, inefficient use of water as well as water leakages are substantial drivers of greenhouse gas emissions – unnecessary amounts of water hereby have to transmitted and distributed, requiring electricity for pumps, treatment and filtering etc. In other words, this is not only waste of money, but also a driver for climate change, with no public value created, only extra problems.

Accordingly, a shift from a supply-side to a demand-side approach to water resources management is suggested.

On the Wastewater Management side, greenhouse gas emissions occurs both in the shape of carbon dioxide (CO2), methane (NH4) and nitrous oxides (NO2), which each requires different measures, but which altogether is technically possible within not just energy-neutrality, but actually within energy-producing set-up. Technologically, a shift from WWTP (Wastewater Treatment Plants) to WRRF (Wastewater Resources Recovery Facilities) is possible. In many places, standards for design of tenders only relates to outdated technologies not taking energy efficiency into account, and combined with public target for wastewater only applied within sector topics notably water quality, the end result may easily be public expenditures spend on improving water quality leading to adding to climate change problems. And probably at the same time not even leading to application of the newest wastewater treatment technologies eg. digitalization.

Altogether, a review of procurement procedures and standards within the scope of the entire water-food-nexus is suggested.

#4 Strengthen the business-innovation-research interaction via a living labs approach

During the next 5-10 years (the time horizon of 14th and 15th 5-Year Plans, respectively EU Green Deal and related Action Plans eg. Zero Emissions Action Plan), substantial amounts will be channeled to finance the green transition. In order to secure maximum public value from these investments, it is paramount that the right choices are made, having adequate long-term perspectives.

In other words, as stated in the previous Policy Recommendations, if the market due to technologically outdates or sector-narrow standards or lack of incentives structures facilitating sustainability favors bulk solutions, instead of procurement of state-of-the-art solutions with long-term resilience and optimal, operational economic profiles.

Having said this, even under ideal circumstances with well-functioning markets it may of huge value to strengthen the business-innovation-research interaction e.g. via living lab structures which can facilitate pilot projects ahead of moving directly into launching the big investment programs.

Further, pilot projects via living labs structures could constitute platforms for showcasing technology transfers from international partners as well as allowing international SMEs to get the first reference at the Chinese market.

It is therefore suggested to support the business-innovation-research interaction by increasing EU and CN funds for companies to become involved in pilot projects.