Discussion on the implementation of national water-saving actions in Changxing

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Abstract. Against the background of deepening Implementing the National Water-saving Action, Changxing adapts to local conditions by strengthening the dual control system of total water resources and consumption intensity. Changxing creating three major water-saving local characteristics such as building contract water-saving management system; promoting efficient and water-saving agriculture; promoting reuse of sewage water. Through these efforts, an upgraded version of water-saving in the new era will be built, comprehensively improve the level of water-saving in the whole society, also promote high-quality and green development of the economy and society.

1. Introduction
Changxing is in the northwest of Zhejiang, at the junction of Jiangsu, Zhejiang, and Anhui Province. The average water resource for many years is 884 million m³, and the per capita water resources are 1,426 m³. Due to the high population density, the per capita water resources are lower than the national and provincial averages. Changxing completed the establishment of the first batch of water-saving societies in Zhejiang Province at the end of 2015, and completed the establishment of a national county water-saving society at the end of 2018. The water-saving work has achieved significant economic, social, and ecological benefits. The total water use in Changxing decreased from 437 million m³ in 2014 to 328 million m³ in 2018; water use per 10,000 yuan of GDP fell from 99.6 m³ in 2014 to 53.9 m³ in 2018, water use per 10,000 yuan of industrial added value dropped from 31.5 m³ in 2014 to 18.5 m³ in 2018. All indicators have exceeded the goals and tasks assigned by superiors, forming a significant local water-saving feature job. In recent years, with the continuous deepening of national water-saving actions, higher requirements have been put forward for county water-saving work.

Based on this background, this article preliminarily discusses the work plan of Changxing to implement the national water-saving action. Under the implementation of the regional water use and intensity control requirements, the rigid constraint of water resources will be further strengthened, water resources management and water conservation efficiency will be improved to achieve obvious results, also economic and social benefits. In the context of the integrated development of the Yangtze River Delta, help Changxing to build a development highland around the Taihu Lake and a strong economy in the Yangtze River Delta.
2. Overall goal
Changxing's industrial economy, urban economic development, population distribution, and resource and environment carrying capacity put high demands on water resources support and guarantee capabilities. The implementation of the national water-saving action[1] in Changxing is based on the completion of the water resources survey and evaluation of Changxing and the investigation and analysis of the status of water supply, closely combining with the regional economic and social development goals, formulating the national water-saving action plan for the implementation of Changxing, and establishing a work promotion system. In the meanwhile, making every effort to create an upgraded version of county water saving in the new era.

2.1. Basic profile
After the first batch of water-saving society construction pilot counties in Zhejiang Province in 2015 and the construction of county-level national water-saving society-compliant counties in 2018, Changxing has formed a water-saving social work system led by the government, departmental actions, and full participation. Changxing has established a leading group for water-saving social work, with an office under it, which to fully lead and coordinate the water-saving work, and form three major water-saving local characteristics. First, the wastewater treatment plant tail water reuse has achieved remarkable results, according to incomplete statistics. At the end of 2017, the utilization rate of recycled water in Changxing reached 29.2%, which is the leading level in the province; the second is to actively implement contract energy management models, and promote enterprises and users to agree on water conservation, pollution control, and unconventional water utilization goals in the form of contracts to achieve benefits sharing, promoting water saving and emission reduction, improving water resource utilization efficiency and benefits, and achieving a clear benefit of 49% of water saving rate, which has been approved by provincial leaders many times. The third is to actively promote high-efficiency agricultural water saving through the integration of high-standard farmland and agricultural irrigation and the construction of modern agricultural parks have comprehensively improved the level of agricultural water saving. In 2019, the effective utilization coefficient of farmland irrigation water in the county reached 0.63, ranking first in the province.

3. Methods and Discussion
On April 24, 2020, the 42nd Executive Meeting of the Zhejiang Provincial Government reviewed and approved the《Zhejiang Water Conservation Action Implementation Plan》. The "Implementation Plan" proposed that the main water-saving goals such as the total amount and intensity of water use in the three phases in 2022, 2025 and 2035, which will be implemented through the implementation of "one action", the construction of "five major projects", and the improvement of "eight mechanisms" to promote the formation of government-led, market-driven, and social participation and national action is a new water-saving situation; at the same time, five safeguard measures are defined: strengthening organizational leadership, strengthening scientific and technological support, ensuring capital investment, strengthening supervision and evaluation, and enhancing water conservation awareness. With the promulgation of the implementation plan for water-saving actions in Zhejiang, the county water-saving work in the province will face new requirements and higher challenges.

3.1. High-quality preparation of implementation plans
The preparation of water-saving action plans is a work that combines technicality and practicability which needs to be designed at the top level[2]. The local government set up a special leading group to earnestly study and implement the requirements of joint water action work in the provincial, departmental, and municipal bureaus, and in-depth study and plan water conservation work. The water conservancy bureau and county water conservation work member units have discussed and researched the details of the action many times and continuously improved the content of our plan. It mainly includes five aspects:
### 3.1.1. Investigation of water saving status and problem analysis

Collect Changxing's physical geography, economic society, water resources development and utilization data, then systematically evaluate the current water use structure, water efficiency and changes in Changxing, then analyses the situation and main problems by the water saving work in Changxing against the national water-saving action requirements.

#### Table 1. Comparison table of water use indicators between Changxing and domestic and foreign.

| Year | Region     | Area (km²) | Population (10000 people) | Total water use (100 million m³) | Water use per ten thousand Yuan GDP (m³) | Water use per ten thousand Yuan Industrial Value Added (m³) |
|------|------------|------------|---------------------------|----------------------------------|------------------------------------------|-----------------------------------------------------------|
| 2018 | Changxing  | 0.1428     | 66.9                      | 3.28                             | 53.9                                     | 18.5                                                      |
| 2018 | Huzhou     | 0.5817     | 302.7                     | 14.01                            | 51.5                                     | 20.2                                                      |
| 2018 | Zhoushan   | 0.1440     | 117                       | 1.62                             | 13.3                                     | 18.7                                                      |
| 2018 | Zhejiang   | 10.3786    | 5737                      | 214.18                           | 33.6                                     | 21.1                                                      |
| 2015 | China      | 963.4057   | 137462                    | 6103                             | 90.0                                     | 58.3                                                      |
| 2017 | Singapore  | 0.0683     | 560                       | 6.94                             | 5.4                                      | 9.5                                                       |

Through the analysis of Table 1, Changxing has a lot of water saving space in comparison with the province, the whole country and even some areas with advanced water using level in the world, especially in comparison with the province’s high-quality development requirements. Through the implementation of the national water-saving action, Changxing has a lot of room for water saving. In advanced areas of domestic and international water conservation, the water conservation work of Changxing will be further improved in an all-round way.

#### Table 2. Water use in Changxing County in recent years. (100 million m³)

| Year | Agricultural water | Comprehensive domestic water | Ecologcal and environmental water | Total water |
|------|--------------------|-----------------------------|----------------------------------|-------------|
|      | Irrigation water   | Forestry, animal husbandry, fishery, and livestock water | Subtotal | Industrial water | Urban public water | Residental water | Subtotal |          |          |
| 2015 | 2.2287             | 0.6564                      | 2.8851                           | 0.6445      | 0.1921            | 0.3242           | 0.5163   | 0.1827   | 4.2286   |
| 2016 | 2.0494             | 0.5104                      | 2.5598                           | 0.6568      | 0.2465            | 0.3329           | 0.5794   | 0.0201   | 3.8161   |
| 2017 | 2.2297             | 0.3513                      | 2.5810                           | 0.4828      | 0.2670            | 0.1977           | 0.4647   | 0.0240   | 3.5525   |
| 2018 | 1.9128             | 0.3617                      | 2.2745                           | 0.5071      | 0.2826            | 0.1948           | 0.4774   | 0.0250   | 3.2840   |
| 2019 | 1.6170             | 0.3183                      | 1.9353                           | 0.4552      | 0.2765            | 0.1583           | 0.4348   | 0.0247   | 2.8500   |

According to Table 2 and Figure 1, the total water uses of Changxing in 2019 was 285 million m³, of which 193.53 million m³ of agricultural irrigation water, accounting for 53.7% of the total water use, and 318.3 million m³ of water use for forestry, animal husbandry and fishery accounted for 12.8. %; industrial water use is 455.2 million m³, accounting for 19.1% of total water use; domestic comprehensive water use is 434.8 million m³, accounting for 13.7% of total water use; ecological environment water use is 0.0247 million m³, accounting for total water use 0.7% of the amount.

According to statistics in recent years, the total water use of Changxing has shown a downward trend year by year. Agricultural water use has always accounted for more than 50% of the total regional water use and is also showing a downward trend; industrial water use has steadily declined, with slight fluctuations in 2016; residential and urban public water use has maintained a relatively stable trend; ecological environment water use has a significant reduction in 2016.

The main agricultural water in Changxing is paddy field irrigation, accounting for more than 50%; the industrial water is mainly state-owned and regulated enterprises, accounting for nearly 20%. With the rapid development of the county's economic life, the adjustment of agricultural planting structure,
and the promotion of water-saving irrigation technologies, the proportion of industrial and domestic water in Changxing will increase in the future, and agricultural water will decline steadily.

![Water use structure chart of Changxing in 2019.](image)

Figure 1. Water use structure chart of Changxing in 2019.

3.1.2. Analysis of water saving goals

Combined with the currently status and existing problems of water saving in Changxing, comprehensive consideration of the city's economic and technological level in the city's planning year, around the main problems existing in the development and utilization of water resources, etc., analysis and put forward the water saving goals of Changxing.

3.1.3. Key Action Tasks for Water Conservation

Formulating water-saving tasks in different areas such as dual control of total intensity, agricultural water-saving and efficiency, industrial water-saving and emission reduction, urban water-saving and loss reduction, unconventional water utilization, technological innovation, etc., and focus on the improvement of management systems and the innovation of market mechanisms, etc., which formulates tasks for the reform of the system and mechanism[3].

3.1.4. Draw up an implementation plan for water-saving actions

Decompose each water-saving work task one by one, at the same time clarify the division of responsibilities, and estimate the investment of the work content, and propose a fund-raising plan.

3.1.5. Propose water-saving action safeguard measures

The safeguard measures for the water-saving action in Changxing were put forward from the aspects of organization, working mechanism, assessment, scientific and technological support, financial guarantee, and water-saving awareness.

4. Key areas of work and results

By carrying out actions in key areas of water-saving in Changxing, we will make up for shortcomings in the construction of a water-saving society, and further improve the level of social water-saving. Water-saving is to reduce emissions, water-saving is to increase efficiency, and water-saving is high-quality green development.
4.1. **Double control of total water consumption and intensity**  
Through the development of Changxing water resources allocation plans, comprehensive verification of water resources supplies and demand information, regional water resources demonstration and full coverage reform, regional water resources allocation according to regional economic and social development, urban development pattern, and regional water resources carrying capacity analysis, in terms of total amount and intensity, refine the rigid constraints of water resources.

4.2. **Agricultural water saving and efficiency**  
Through the development of high-efficiency water-saving improvement projects in medium-sized irrigation areas, the implementation of comprehensive agricultural water price reforms, vigorously promote the construction of high-efficiency water-saving modern parks, promote agricultural high-efficiency water-saving irrigation technologies, build water-saving irrigation areas, explore ecological green fishery breeding technologies, and implement agricultural water-saving increase efficiency, and strive to further increase the effective utilization coefficient of farmland irrigation water to advanced indicators[4].

4.3. **Industrial water saving and emission reduction**  
Through the implementation of cleaner production in industrial enterprises, compared with the new version of Zhejiang Province's water use quota (2019), reform and improve the water efficiency of industrial enterprises, and achieve 100% coverage of the construction of water-saving enterprises in high water-using industries in Changxing. Also, the water-using enterprises with an annual water use of more than 50,000 m³ have implemented water balance testing, innovatively implemented water use indicators into the hero evaluation system of industrial enterprises per mu and explored the expansion of the use of sewage treatment plant tail water by power generation enterprises to further improve regional industrial water saving and emission reduction.

4.4. **Water saving and loss reduction in cities**  
Take the opportunity of the leakage compliance action of the urban public water supply unit's pipeline network to comprehensively improve the leakage management level of the public pipeline network and realize the loss reduction and efficiency increase of public water supply[5]. Vigorously implement the construction of water-saving communities, water-saving public units, water-saving hotels, schools, hospitals, and supermarkets.

4.5. **Water-saving innovation**  
Continue to introduce third-party water-saving service units, explore the implementation of contracted water-saving management models, water manager management models, and adopt a dual-handed government and market model to improve the efficiency of water-saving professional management of units. Actively explore the reform and innovation of water rights trading, also implement water supply-side reforms to realize the ecological value of high-quality water resources in terms of the distribution of water rights in the high-quality water resources industry of reservoirs and the optimal dispatch of water supply reservoirs[6].

4.6. **Results**  
By 2022, rapid breakthroughs will be made in water use in key areas, (water-saving production and lifestyles have been initially established, water-saving industries have begun to take shape, and the proportion of unconventional water utilization has further increased), and the awareness of water use in the whole society has increased significantly. Water use per 10 thousand Yuan GDP and water use per 10 thousand Yuan industrial value-added value were reduced by more than 55% and 54% respectively compared with 2015. The reuse rate of industrial water used above designated size reached more than 91%, and the leakage rate of urban public water supply pipelines was controlled
within 10%, the effective utilization coefficient of farmland irrigation water will be increased to over 0.633, and the total amount of water use will be controlled within 500 million m³.

By 2025, water-saving policies and regulations, standard systems, and market mechanisms will be basically complete, technical support capabilities will continue to increase, water efficiency indicators will continue to improve, and Changxing’s water resources conservation and recycling level will be at the forefront of Zhejiang. Water use per 10 thousand Yuan GDP and water use per 10 thousand Yuan Industrial value-added value were reduced by more than 56% and 55% respectively from 2015, and the total water use is controlled within 550 million m³.

By 2035, a water-saving policy and regulation system, a standard system, a sound market regulation mechanism, and an advanced technical support system will be formed. Changxing’s water resources conservation and recycling will reach the national advanced level, and the scale of water resource utilization and development and industrial structure will be realized.

5. Conclusions
Changxing has successively won the national water-saving county, the first batch of water-saving society pilot counties in Zhejiang, and the county-level national water-saving society standard counties. Water-saving work has a certain foundation. With the implementation of the national water-saving action, Changxing’s water-saving work faces new requirements and challenges. In order to do this work better, there are four suggestions for reference.

5.1. Attaches great importance to the construction of water-saving organization system
The water-saving organization system is the prerequisite for the county water-saving work. Water-saving work involves industrial layout, population distribution, urban planning, water supply and drainage and other fields. It needs to be collected, interpreted, and compiled to adapt to the local economic and social development. Departmental and multi-field cooperation requires a strong water-saving organization system.

5.2. Carefully organize the preparation of the action plan
The Changxing water-saving action plan needs to consider the actual economic and social development of the local area and adjust measures to local conditions. The action plan is a guideline and a top-level design. Organizing the preparation of the action plan is very conducive to the implementation of the next water-saving action.

5.3. Plan water-saving social publicity work in advance
Water-saving work is inseparable from the participation of the whole society. We use multiple channels to carry out water-saving publicity work, enhance public participation and sense of gain in water-saving work, and actively carry out water-saving publicity to enter factories, schools, communities, which improve the coverage of public water-saving knowledge and provide a good social atmosphere for water-saving actions.

5.4. Actively innovate local water-saving features
It is necessary to combine higher-level requirements, creatively carry out Changxing water-saving work, explore the formation of bright spots in line with local development characteristics, comprehensively improve the level of water-saving management, and serve the high-quality development of the economy and society.

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