



Active Leakage Control Applying in Liantang Utility

YUCHEN LU; CHUNLAI YI; JIE LI

Preface

- ▶ with the rapid economic development and urban population expansion in China, the problem of the shortage of urban water supply resources has become increasingly prominent.
- ▶ The focus of China's water Utilities has also shifted from ensuring water supply, safe water supply and high-quality water to leakage control.
- ▶ ALC has become the mainstream of leakage control technology.

Shenzhen loss in recent years and the typical management model

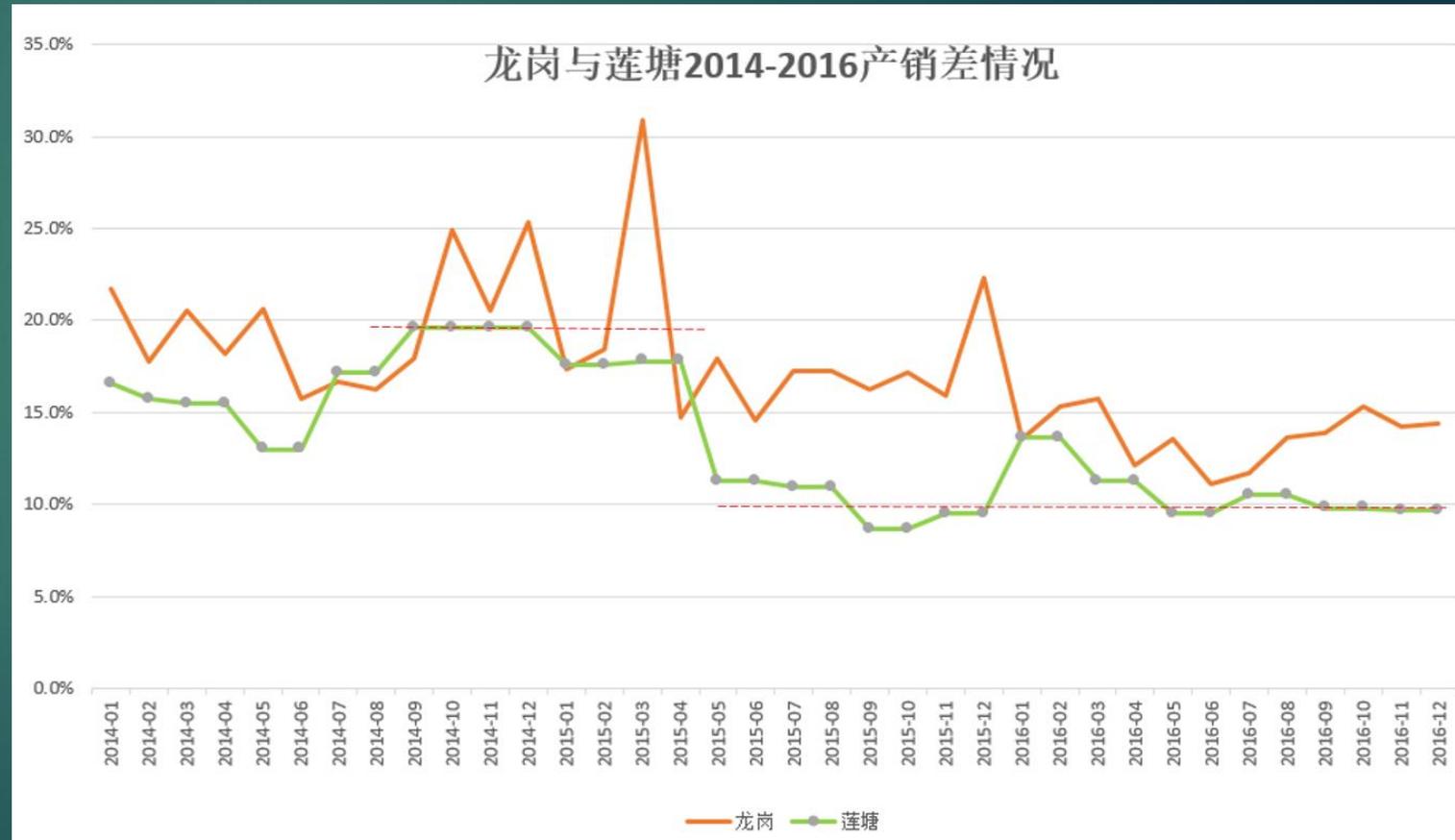
Table 1 Difference between NRW rate in 2014-2016 of Shenzhen Water Group

- ▶ Area: 2,000 square kilometers
- ▶ Population: 20 million.
- ▶ Branches: 6

Branch name	2014	2015	2016
Longgang	19.7%	18.2%	13.6%
Liantang	16.9%	12.6%	10.7%
Longhua	15.6%	15.4%	13.4%
Headquarters	12.7%	13.3%	13.7%
Guangming	11.6%	11.6%	13.0%
Bao'an	9.7%	10.6%	10.1%

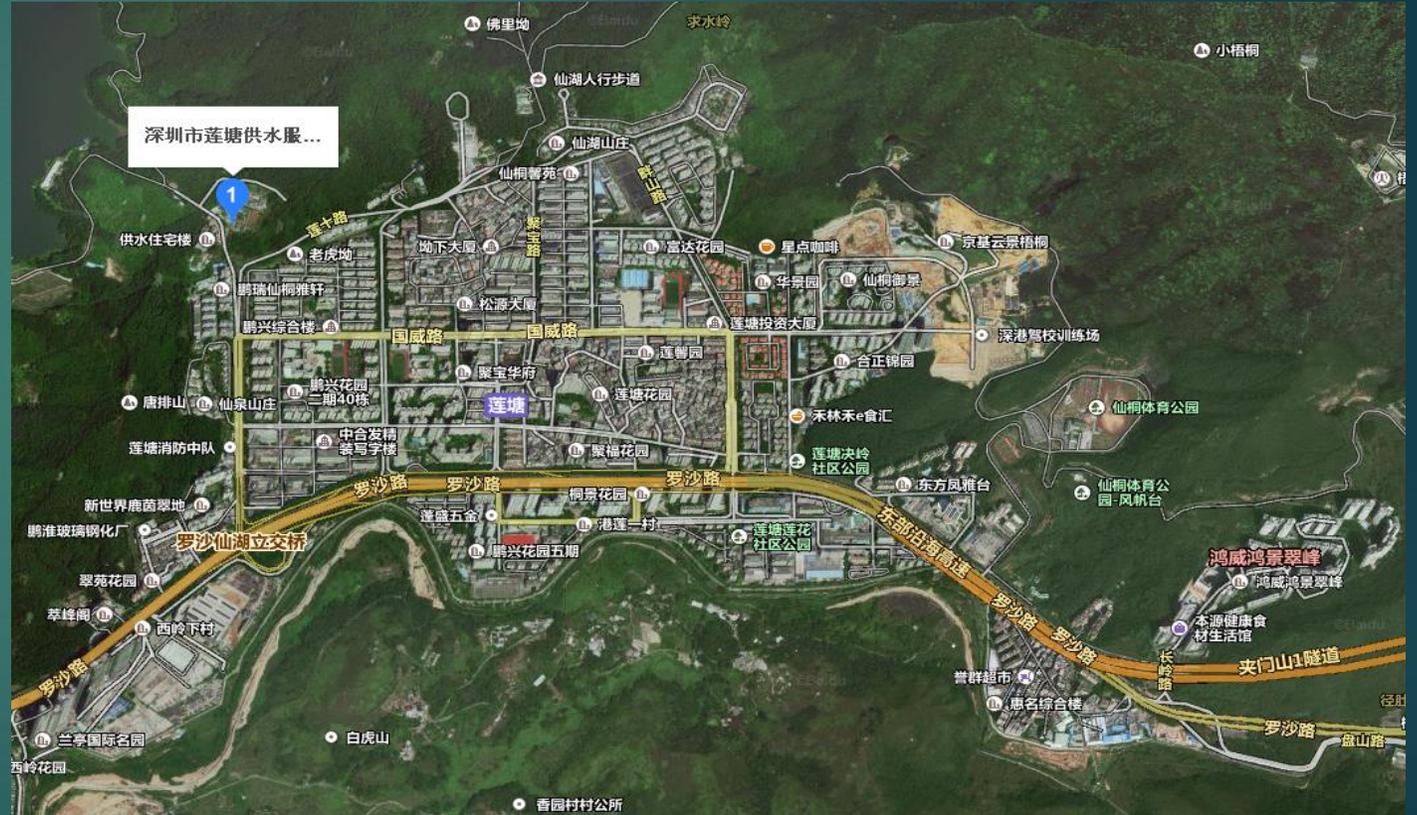
Shenzhen loss in recent years and the typical management model

- Longgan(red): the total length of Longgang pipeline reconstruction has been 387 km at ratio of 19.4% in 4 years.
- Liantang: ALC method
- ALC method is more active, more accurate and more efficient



Active leakage control in Liantang

- ▶ Area: 15 square kilometers
- ▶ Population: 300,000
- ▶ Length of pipe network: 161 km
- ▶ Water meters: 18,588
- ▶ NRW : 160,000 m³ / month at rate of 16.9% in 2014



Active leakage control in Liantang

- ▶ water balance

The volume of water using the method of calibration of the flow meter, the error is + 2.7%.

- ▶ Inlet water meter calibration and water meter measurement efficiency assessment.

Table 2 Liantang meter measurement efficiency evaluation

Diameter	DN15	DN20	DN25	DN40	DN50	DN80	DN100	DN150
Measurement efficiency	100.7%	99.7%	99.8%	99.7%	97.9%	92.6%	98.8%	100%
Small diameter measurement efficiency:100.1%				Large diameter measurement efficiency:98.3%				
Measurement efficiency	99.1%							
The proportion of total water	15.7%	15.9%	5.1%	3.5%	7.1%	7.7%	19.7%	19.2%

Active leakage control in Liantang

Apparent leakage $\approx 84,481\text{m}^3$ / year,
apparent leakage rate $\approx 0.8\%$;

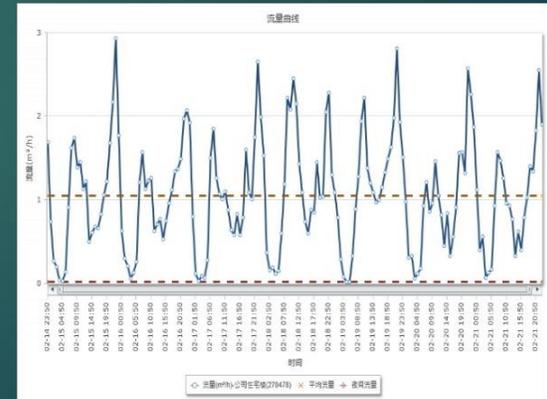
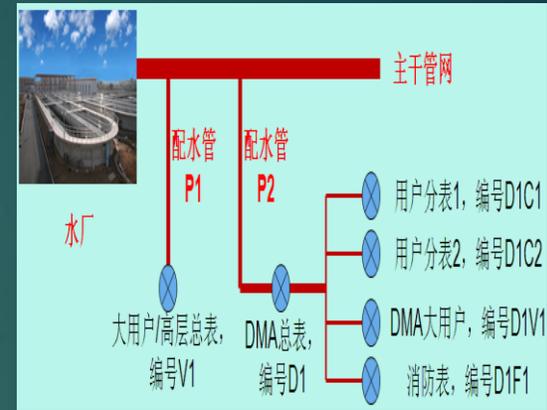
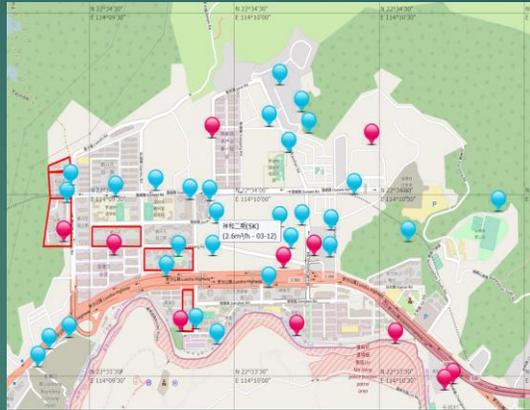
Physical leakage $\approx 1,514,380\text{ m}^3$ /
year, physical leakage (m³ / h) $\approx 173\text{ m}^3$
/ h, physical leakage rate $\approx 13.9\%$;

the leakage strategy should focus on
dealing with physical leakage.

Item	Value
Total reading water (water supply)	11,195,528 m ³
Sum of Sub-meter water (water sales)	9,302,335 m ³
None-income water	1,893,193 m ³
Margin rate	16.9%
The parent-meter standard measurement of water (eliminate error)	$(11,195,528\text{m}^3/102.7\%) = 10,901,196\text{ m}^3$
Standard non-profit water (consumer)	$10,901,196\text{m}^3 - 9,302,335\text{m}^3 = 1,598,861\text{ m}^3$
Leakage rate (difference)	14.7%
Apparent leakage	$9,302,335\text{m}^3/99.1\% - 9,302,335\text{m}^3 \approx 84,481\text{ m}^3$
Physical leakage	$1,598,861\text{m}^3 - 84,481\text{m}^3 = 1,514,380\text{ m}^3$
Physical leakage (m ³ / h)	$1,514,380\text{ m}^3 / 24 \times 365 \approx 173\text{ (m}^3/\text{h)}$

Active leakage control in Liantang

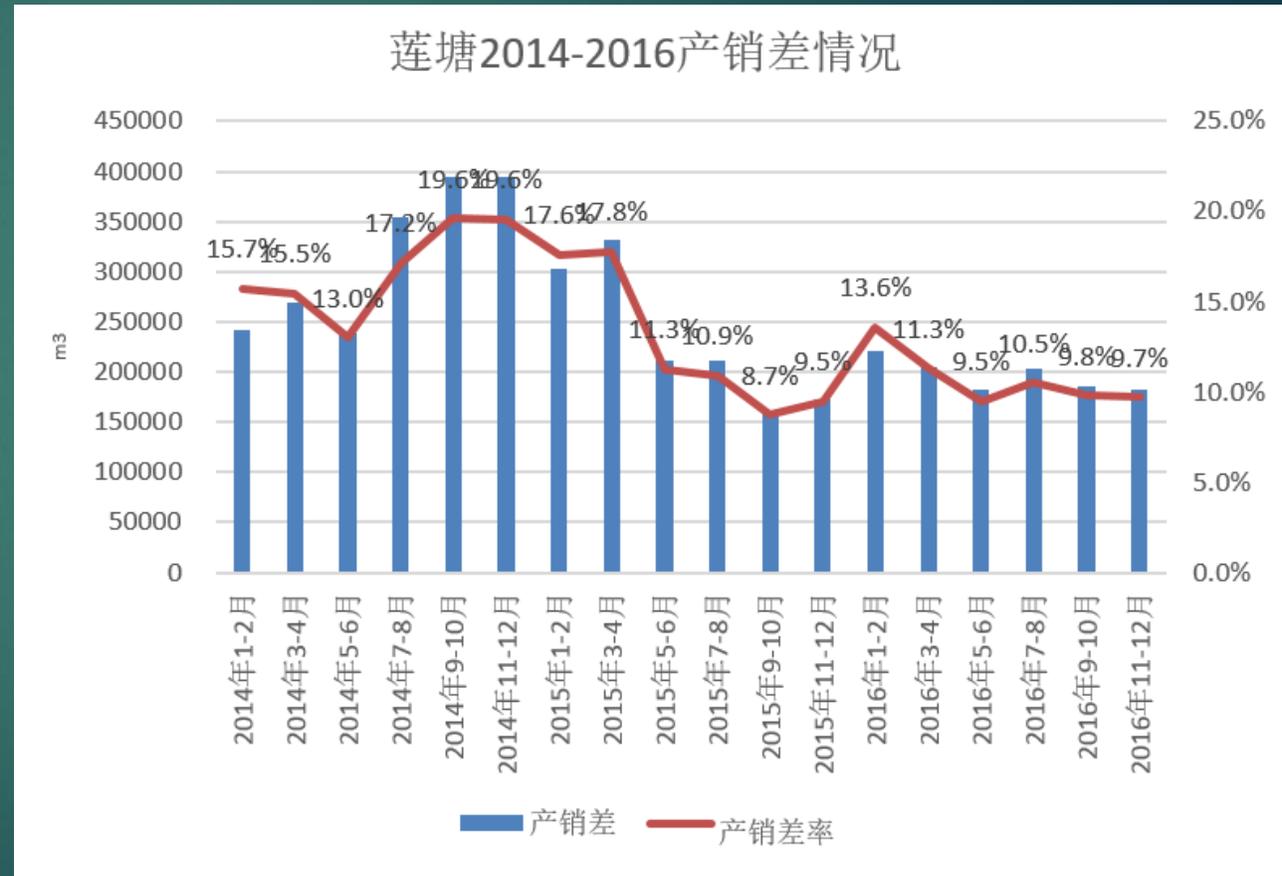
- ▶ 63 DMAs were built
- ▶ DMA method is employed for the residential district. The leakage is evaluated firstly through the MNF of master meter, and then arrange the staff to conduct a weekly meter reading for comparison. When the margin between production and sales becomes larger, and then launch locating leaks and repairing pipe network.
- ▶ Large Customer:
 - ▶ For the distribution pipe for business users or high-level residential master meter, the water loss does not belong to the loss of water supply utility, but included in the water meter measurement error. When the water shows abnormalities, immediately arrange the water meter manual check on site.
- ▶ Data Online
 - ▶ In 2015, a total amount of 52 metered points in 43 DMA were upgraded to the GPRS remote monitoring models.



Active leakage control in Liantang

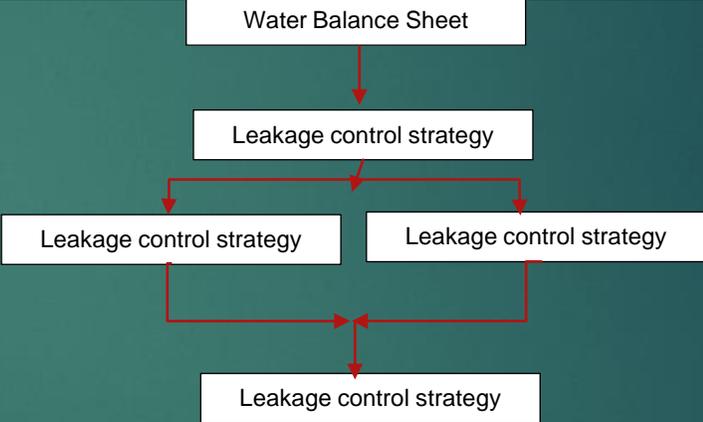
The NRW of these newly constructed DMA dropped from 18% to 6.5%, with an estimated leakage loss of 700,000 m³ / year

The water supply cost was saved at about RMB 770,000.



Active leakage control in Liantang

- ▶ The Water Supply Network Leakage Index (ILI) has been changed from 5.5 to 3.9 and the target has been raised from B level in developing countries to A level in developed countries, indicating a good level of leakage control.
- ▶ Project investment is 1.08 million RMB, reducing water supply costs about 77 million RMB / year, then investment recovery cycle is about 1.5 years.
- ▶ A complete set of leakage control technology route is summarized in Liantang project by DMA,

Technical Roadmap	Detail of work
 <pre> graph TD A[Water Balance Sheet] --> B[Leakage control strategy] B --> C[Leakage control strategy] B --> D[Leakage control strategy] C --> E[Leakage control strategy] D --> E </pre>	<ol style="list-style-type: none"> 1. Calibration of factory meters 2. Efficiency assessment of meters
	<ol style="list-style-type: none"> 1. Leakage data correction 2. Apparent leakage calculation 3. Physical leakage quantification
	<ol style="list-style-type: none"> 1. Pressure measurement 2. Building DMA 3. Cycle management of large customers' meters
	<ol style="list-style-type: none"> 1. Data Monitoring 2. Leakage analysis 3. BPR

Summary

- ▶ In general, physical leakage is characterized by uncertainty about where, when and how often. Leakage control:
- ▶ First of all, DMAs based on the pipe network grid, the problem of location is solved well.
- ▶ Secondly, in order to solve the problem of leakage discovery time, it is necessary to change the information collection mode of DMA. By deploying data collection terminals, measuring the MNF and using GPRS transmission technology to timely upload data, the leakage can be found in time.
- ▶ Finally, to solve the problem of leakage measurement, by analyzing the MNF data, we can get the physical leakage of water. At the same time, with the MNF as the leakage control observation index, we can calculate the incremental leakage, then conduct precise measurement management.
- ▶ Thus, the control of leakage are solved among the three aspects of "top design, timely data transmission, and precise measurement".

Thank you