9 March, 2012
Canton Tower Case Study
A successful implementation of a non-chemical solution for scale and rust removal and prevention in a water-cooled HVAC system
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Scale & Rust Problem
System was very dirty with scale formation and rust and shutting down after 20 minutes of operation. Approach Temp or Approach temperature difference was > 5°C

Opening Condenser
for inspection on 2 March, 2012.

Clean Condenser Tubes
Free of scale and rust since installing Kiko cartridges in June 2011

2012 Canton Tower
Customer Case Study

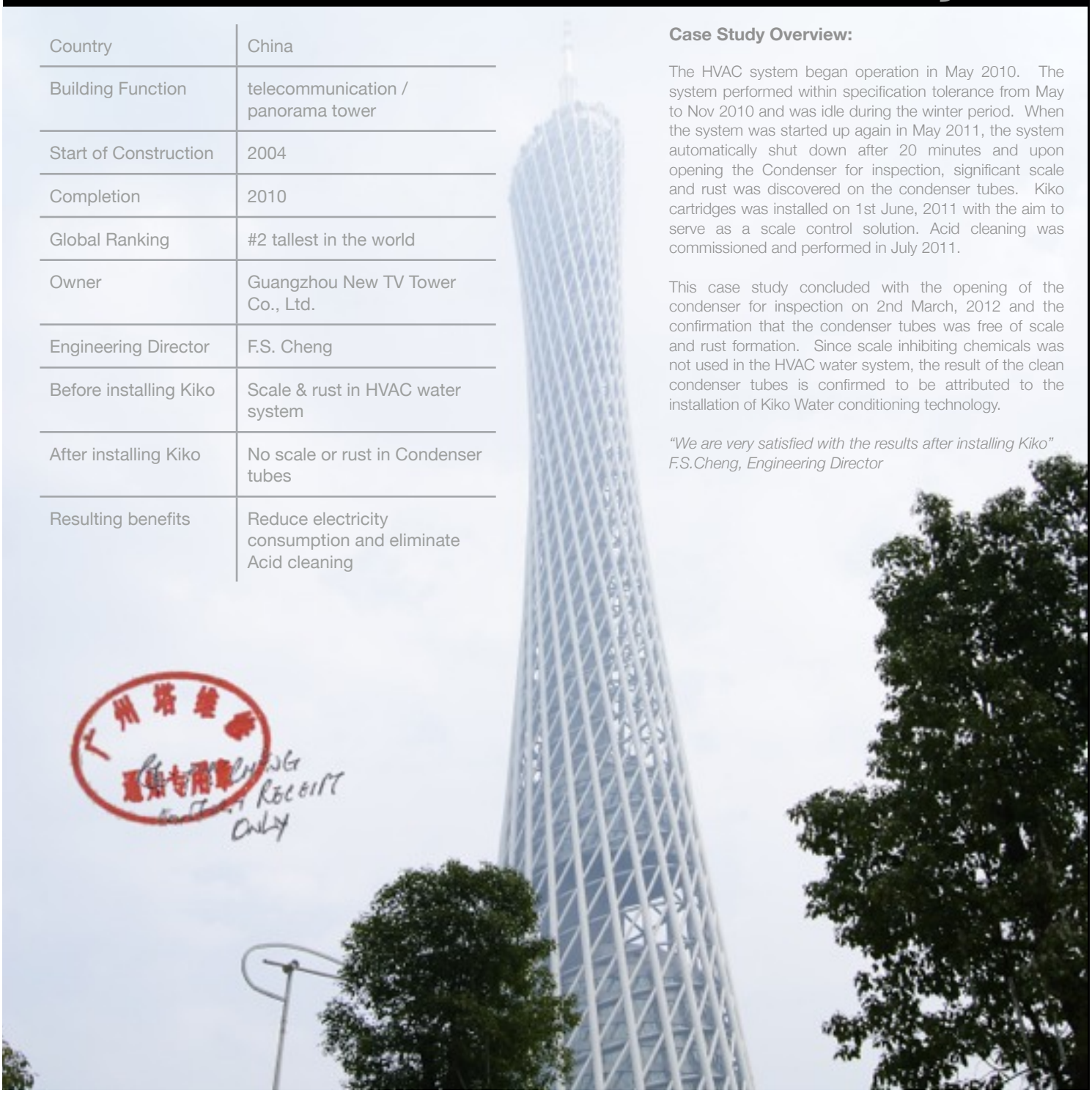
Country	China
Building Function	telecommunication / panorama tower
Start of Construction	2004
Completion	2010
Global Ranking	#2 tallest in the world
Owner	Guangzhou New TV Tower Co., Ltd.
Engineering Director	F.S. Cheng
Before installing Kiko	Scale & rust in HVAC water system
After installing Kiko	No scale or rust in Condenser tubes
Resulting benefits	Reduce electricity consumption and eliminate Acid cleaning

Case Study Overview:

The HVAC system began operation in May 2010. The system performed within specification tolerance from May to Nov 2010 and was idle during the winter period. When the system was started up again in May 2011, the system automatically shut down after 20 minutes and upon opening the Condenser for inspection, significant scale and rust was discovered on the condenser tubes. Kiko cartridges was installed on 1st June, 2011 with the aim to serve as a scale control solution. Acid cleaning was commissioned and performed in July 2011.

This case study concluded with the opening of the condenser for inspection on 2nd March, 2012 and the confirmation that the condenser tubes was free of scale and rust formation. Since scale inhibiting chemicals was not used in the HVAC water system, the result of the clean condenser tubes is confirmed to be attributed to the installation of Kiko Water conditioning technology.

"We are very satisfied with the results after installing Kiko"
F.S.Cheng, Engineering Director



OPERATING PARAMETERS	
HVAC System	YORK
Chillers	4
Cooling Tower	4
Chemicals Used	Only biocide
Start Operation	May 2010

INSPECTION SCHEDULE	
1st Condenser Inspection	July 2011
Observation upon inspection	Scale & Rust
Acid Cleaning	July 2011
2nd Condenser inspection	March 2012
Observation upon inspection	No scale No rust

KIKO INSTALLATION SCHEDULE	
Installed	1 June 2011
Installed Location	- Water make-up tank - Chiller strainer
Cartridges used	16 in Cooling Tower 16 in Chiller strainer

PERFORMANCE SUMMARY

Before installing Kiko System

HVAC system performed within specification tolerance from August to November 2010. It was not operated during the winter months and upon starting up in May 2011, the system auto-shutdown after 20 minutes and Approach Temp/Approach Temperature Difference exceeded 5°C, which indicates severe reduction in heat exchange efficiency.

Upon opening condenser for inspection in July 2011, severe scaling and rust was discovered on tube surfaces and was identified as the cause of the shut down. Acid cleaning was undertaken immediately and system performance as measured by the Approach Temp fell back closer to specification tolerance but still not at optimal performance level (at least 2°C or lower).

KIKO INSTALLATION SUMMARY

Kiko cartridges was installed on 1 June, 2011

A total of 32 Kiko cartridges was installed in the Canton Tower HVAC water system. The purpose of the Kiko system was to keep the condenser free of scale and rust. In a dirty system, scale and rust will be removed in 2 to 4 months however, as the system was acid cleaned in July, there was little scale or rust to be removed from the tube surface. Thus, Kiko system simply continued to remove as well as prevented scale and rust from further forming on the condenser tube surface.

PERFORMANCE SUMMARY

After installing Kiko System

Since Kiko cartridges was installed in June and acid cleaning was performed in July, the condenser tubes have remained free of scale and rust - as observed when the condenser was opened for inspection on 2 March 2012. Additionally, the heat exchange efficiency as measured by the Approach Temp or Approach Temperature Difference was maintained at close to 1°C as compared to > 5°C difference before installation. It should be noted that a reduction of the Approach Temp/ Approach temperature difference by 4°C (5°C minus 1°C) is a potential 4-5% reduction in electricity consumption.

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SCALE-FREE TUBES

All photos clockwise from top are of Chiller taken on 2 March 2012

A SCALE-FREE SYSTEM RESULTS IN LOWER ENERGY CONSUMPTION

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DATA SUMMARY

- HVAC System by YORK
- 4 Chiller
- 4 Cooling water tower
- Began operation in August 2010
- Kiko cartridges installed on 1 June 2011
- Condenser opened for inspection in July 2011 and observed significant scale and rust build-up on tubes
- Acid cleaning was carried out after inspection
- Biocides used for bacterial and microbiological control
- Chemicals is not used for scale inhibition

Observation Before Kiko Installation

For Chiller #1 on 17-May-2011
- Median Approach Temp on Evaporator was 1.7°C
- Median Approach Temp on Condenser was 5.05°C

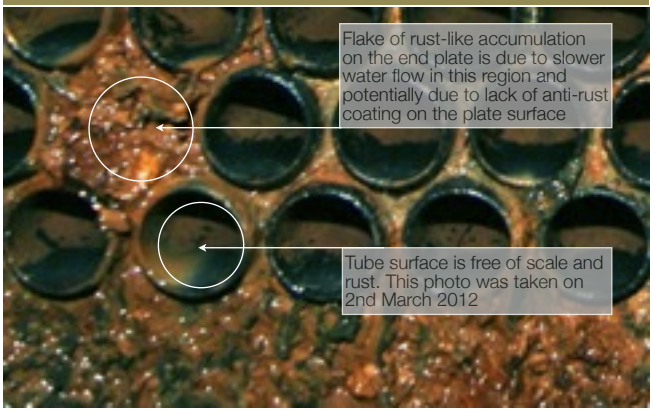
For Chiller #1 on 17-Oct-2011
- Median Approach Temp on Evaporator was 2.1°C
- Median Approach Temp on Condenser was 2.8°C

Observation After Kiko Installation

For Chiller #1 on 2-Mar-2012
- Median Approach Temp on Evaporator was 1.4°C
- Median Approach Temp on Condenser was 1.0°C

Upon opening Chiller #1, the tubes was found to be clean and scale-free, however, rust was noticed to have accumulated on the end plate of the condenser vessel. It is surmised that this accumulation is due to two factors:

- Slower water flow at end section of the condenser
- the lack of anti-rust coating on the plate



Evaporator	#1			#2		
17-May-11	CWO	SAT	STD	CWO	SAT	STD
900	7.2	5.3	1.9	7	5.3	1.7
1130	7.2	5.5	1.7	7.6	5.9	1.7
1400	7.1	5.2	1.9	7.7	6	1.7
1630	7.2	5.5	1.7	7.4	6.1	1.3
1900	7.1	5.4	1.7	7.5	5.9	1.6
2130	7.3	5.6	1.7	7.2	5.8	1.4
Median STD	7.2	5.45	1.7	7.45	5.9	1.65

Kiko Cartridge installed on June 1, 2011

17-Oct-11	CWO	SAT	STD	CWO	SAT	STD
900	7.5	5.3	2.2	7.5	5.4	2.1
1130	7.5	5.4	2.1	7.5	5.5	2
1400	7.5	5.4	2.1	7.5	5.3	2.2
1630	7.5	5.4	2.1	7.5	5.3	2.2
1900	NO DATA					
2130						
Meidan STD	7.5	5.4	2.1	7.5	5.35	2.15

Only Chiller #1 was in operation

2-Mar-12	CWO	SAT	STD	CWO	SAT	oach Te
900	7.2	5.8	1.4			0
1130	7.2	5.8	1.4			0
1400	7.2	5.8	1.4			0
1630	7.2	5.8	1.4			0
1900	NO DATA					
2130						
Median STD	7.2	5.8	1.4			

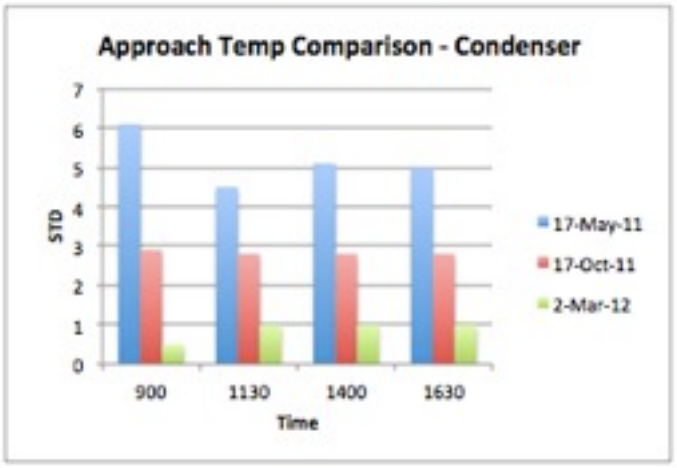
Condenser	#1			#2		
17-May-11	Leaving Temp	SAT	STD	Leaving Temp	SAT	STD
900	29.2	35.3	6.1	29	32.8	3.8
1130	31.3	35.8	4.5	31.1	36	4.9
1400	31.8	36.9	5.1	31.8	36.7	4.9
1630	31.7	36.7	5	31.8	36.2	4.4
1900	32	36.4	4.4	31.7	36.5	4.8
2130	30.2	35.7	5.5	30.2	35.6	5.4
Median STD	31.5	36.1	5.05	31.4	36.1	4.85

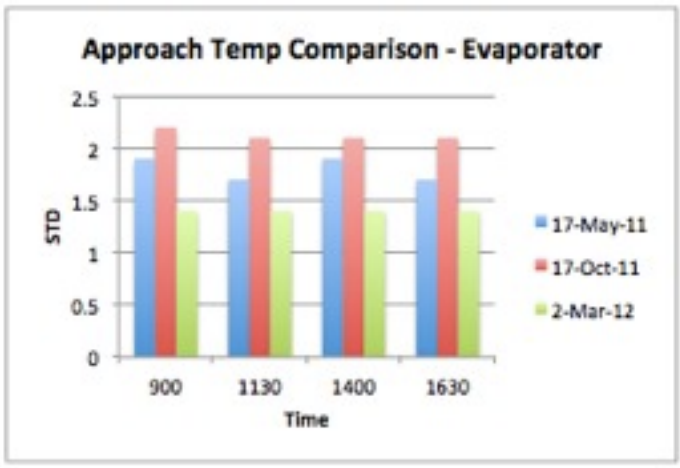
Kiko Cartridge installed on June 1, 2011

17-Oct-11	Leaving Temp	SAT	STD	Leaving Temp	SAT	STD
900	34.1	37	2.9	33.2	37	3.8
1130	34.2	37	2.8	33.1	37	3.9
1400	34.2	37	2.8	33.2	37	3.8
1630	34.2	37	2.8	33.2	37	3.8
1900	NO DATA					
2130						
Median STD	34.2	37	2.8	33.2	37	3.8

Only Chiller #1 was in operation

2-Mar-23	Leaving Temp	SAT	STD	Leaving Temp	SAT	STD
900	32.2	32.7	0.5			
1130	32	33	1.0	NO DATA		
1400	32	33	1.0			
1630	32	33	1.0			
1900						
2130						
Median STD	32	33	1.0			





Approach Temp Difference > 2.0°C indicates poor heat exchange and imply scale and/or rust formation on the heat exchange surfaces. 1.0°C Approach Temp imply a very clean

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