

The background of the slide is a photograph of a large industrial facility, likely a chiller plant, with numerous pipes, structural steel, and walkways. The image is overlaid with a semi-transparent green filter. The text is centered over this background.

Presentation of

Chiller Plant Optimization: *A Case Study*

Presented by

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PARTNERS FOR WHAT'S POSSIBLE

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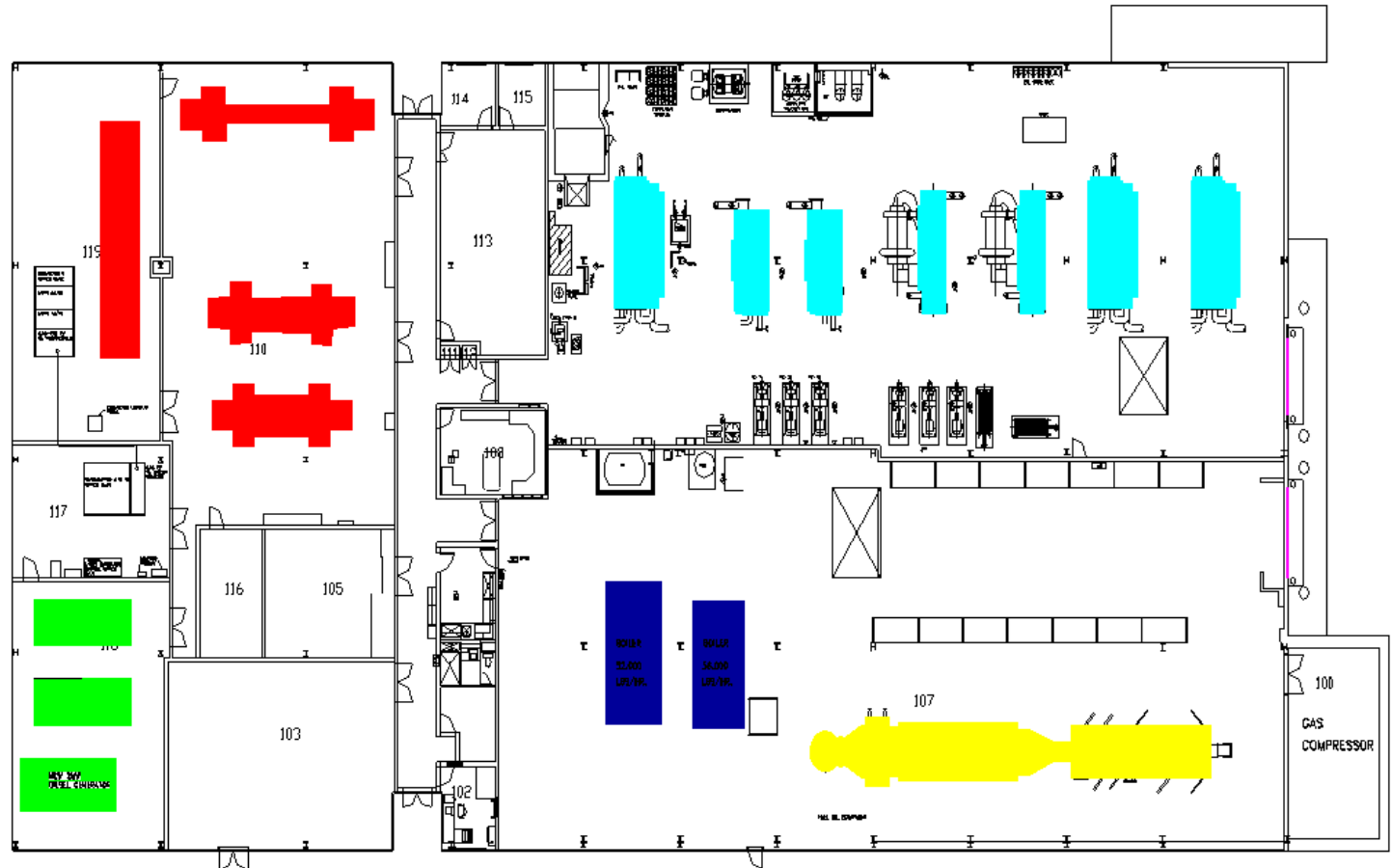
The site

- ◆ Large pharmaceutical client
- ◆ 5 MW cogen
- ◆ 88,000 PPH of boiler capability
- ◆ 8,200 tons of chiller capability
- ◆ Free cooling
- ◆ Diverse chillers
- ◆ 4 MW of diesel peak shaving

The site



Plant layout



- Boilers
- Cogen
- Chillers
- Peak Shaving Diesels

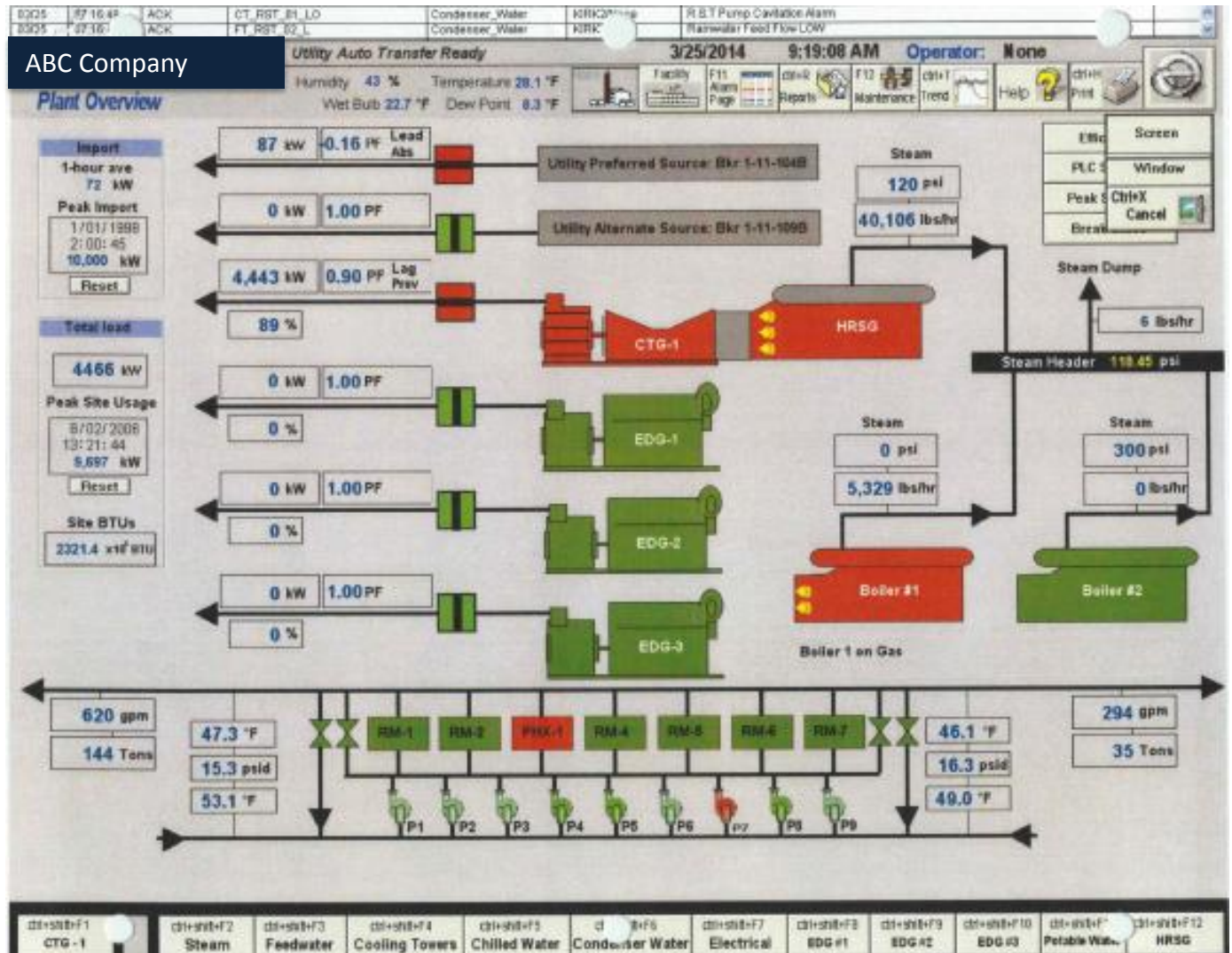
Background

- ◆ Plant control system was upgraded to PLCs in 2001
- ◆ System design was/is robust
 - ❖ Flow meters on both sides of each chiller
 - ❖ Variable position control valves
 - ❖ Pressure, flow, and temperature at critical points in the plant
 - ❖ Flow meters on all towers
 - ❖ Variable position control valves on all towers
 - ❖ Real time KW available from some equipment

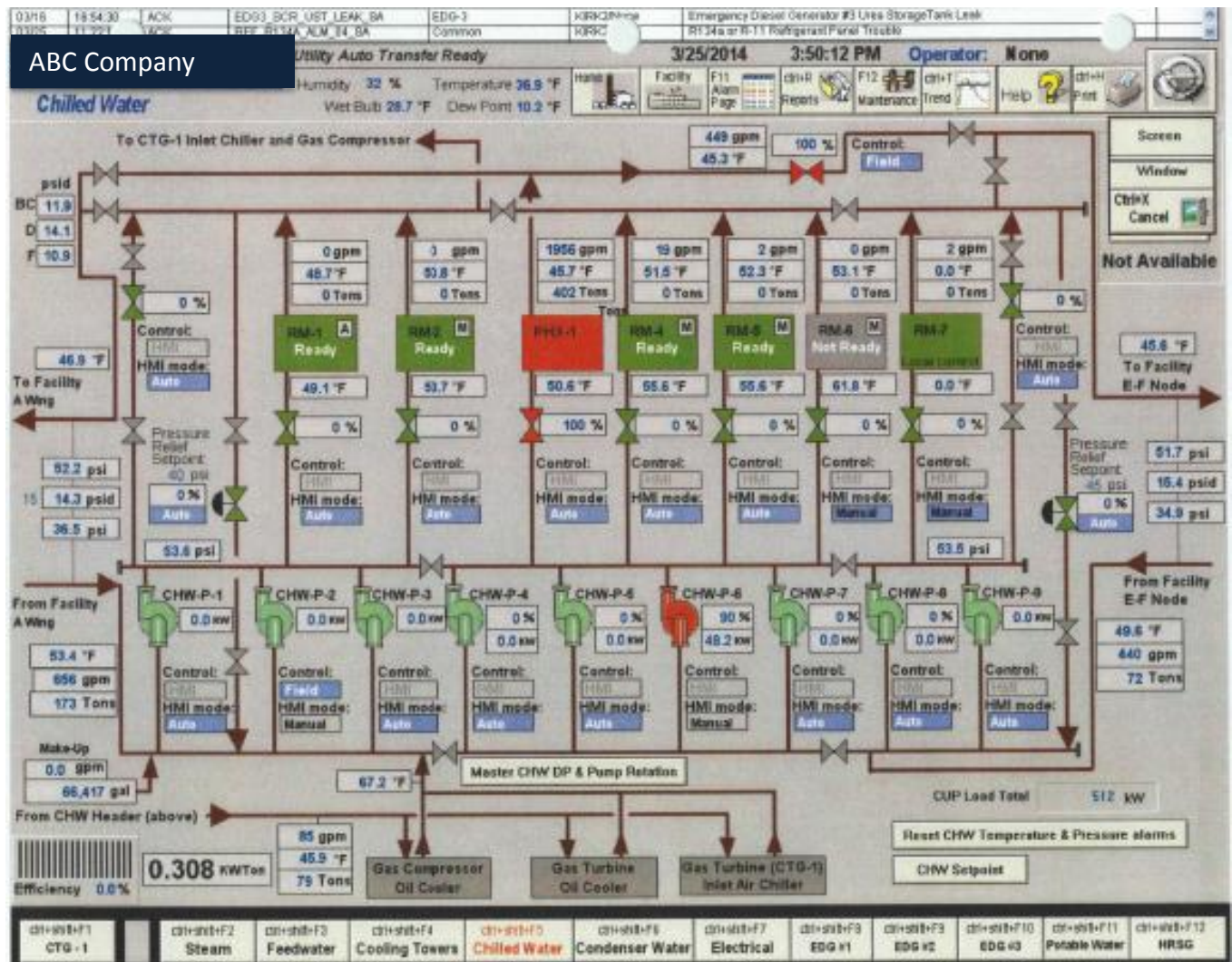
Background

- ◆ Overall the system was in good shape
- ◆ Site operation is largely outsourced
- ◆ Several chillers had been replaced in recent years
- ◆ Cooling tower had been replaced and changed from a four cell to six cell tower
- ◆ VFDs added to five of nine chilled water pumps

Visibility/Controllability

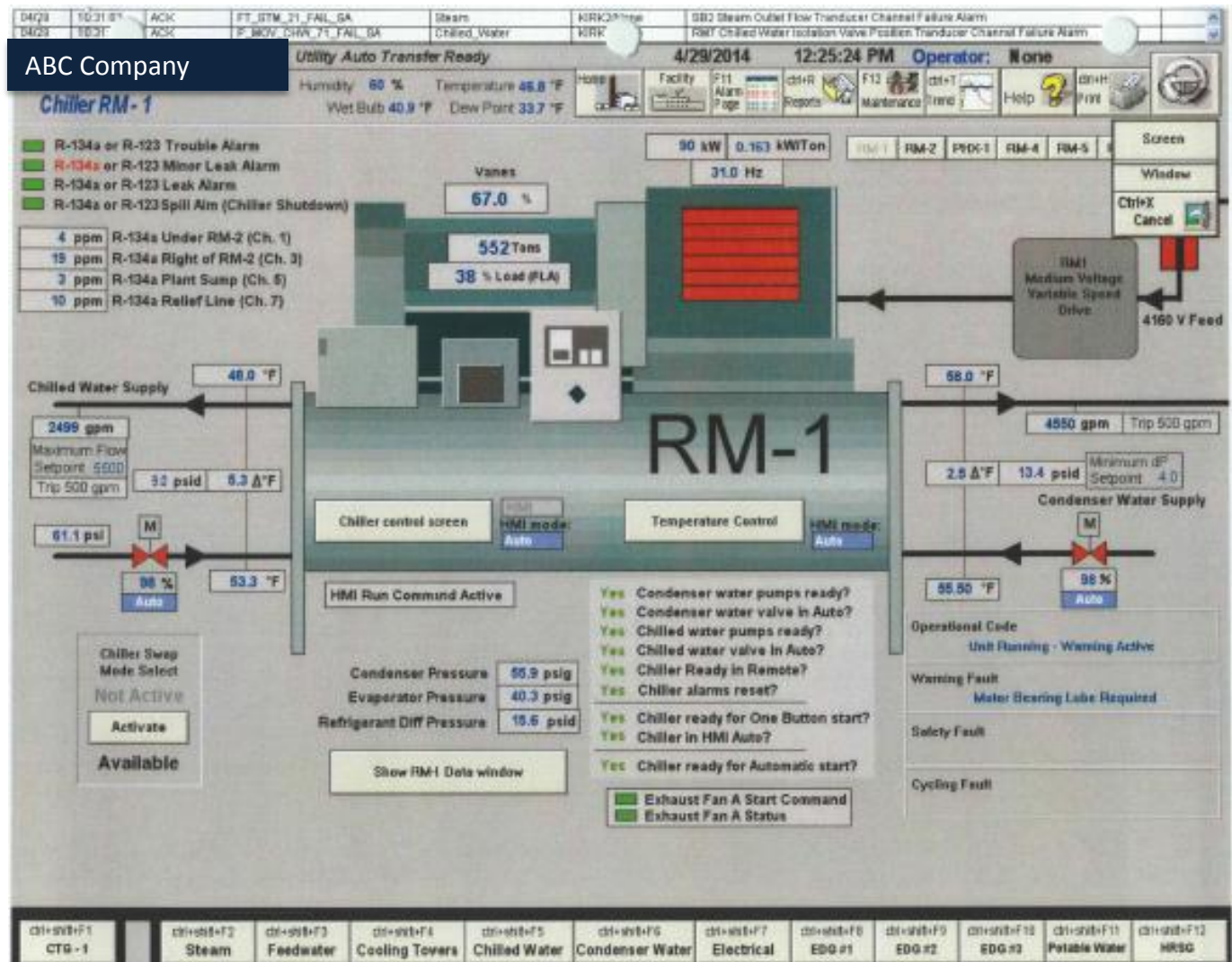


Visibility/Controllability



Visibility/Controllability

ABC Company



What the client was considering

- ◆ A very large investment in a third party chiller optimization program

Our advice

- ◆ They already had the tools to optimize
- ◆ The plant had substantial control flexibility
- ◆ Updates would probably be minor
- ◆ That someone needed to dig into the details
- ◆ They could still consider a larger and more complex project, if warranted

First step

- ◆ Spend time in the plant working with staff to understand current operations
- ◆ Review the original sequence (2001)
- ◆ Review how new equipment was integrated into the original sequence

Second step (minor capital spend)

- ◆ Move the differential pressure sensors from the plant to the most remote location
- ◆ Install VFDs on the four remaining pumps – client had left over VFDs from another project!
- ◆ Install KW transducers on the condenser water pumps - all energy associated with the chiller plant would now be available in real time
- ◆ Total capital investment of \$93,000

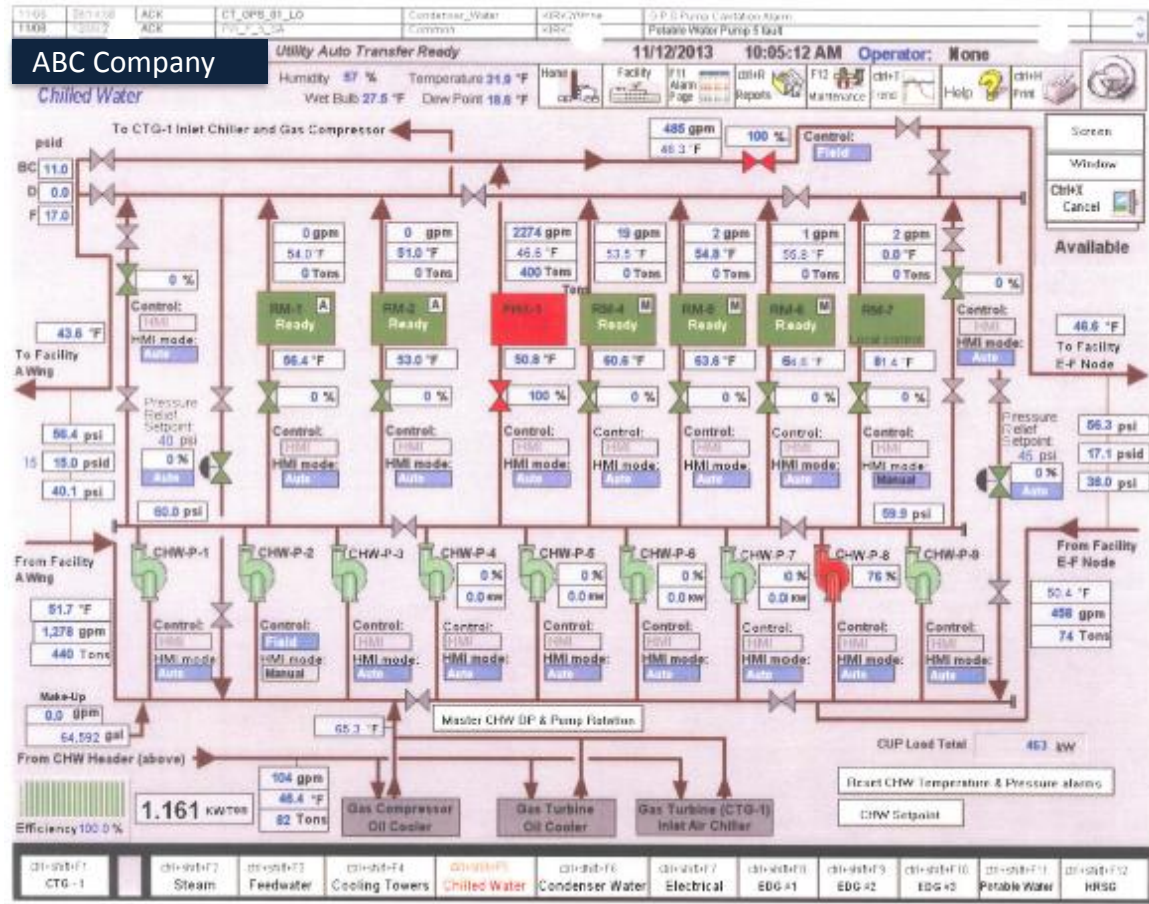
Third step

◆ Document, implement, test

- ❖ Plant PLC automatically selects the lowest remote DP, failure modes programmed
- ❖ Pump control algorithm updated to fully utilize all eight VFD pumps
- ❖ Tower sequence updated to actively control flow to all six cells (smart to flow)
- ❖ Counter flow tower used for winter mode
- ❖ Corrected tower winter mode selection, which had been looking at wet bulb
- ❖ Free cooling: all interlocks removed; corrected the logic which was forcing the system out of plate and frame mode when temperature was below 18 degrees
- ❖ Automatic chilled water reset instituted
- ❖ Automatic condenser water reset instituted
- ❖ Condenser water pump selection updates
- ❖ Duct burner control and chiller/steam dump logic improved

CHW Pump Savings

Winter Mode with Plate and Frame On Line-Base Case

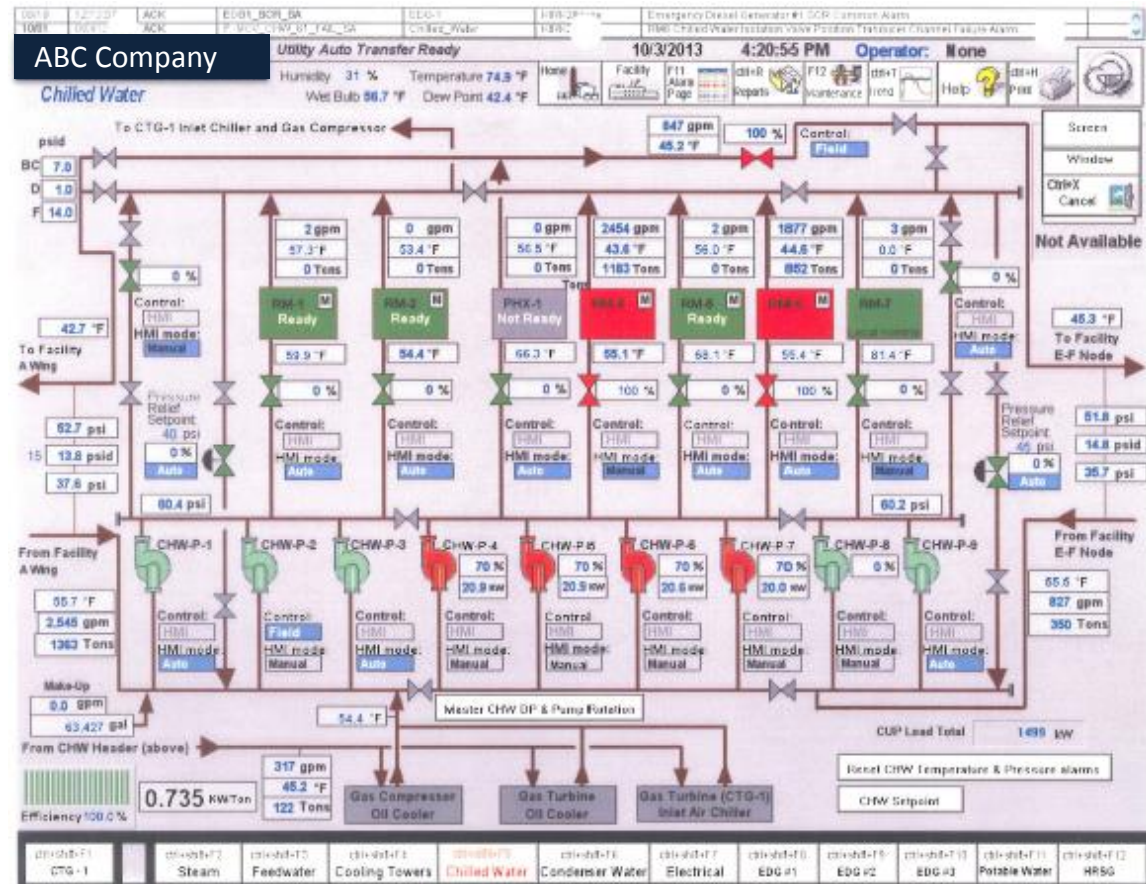


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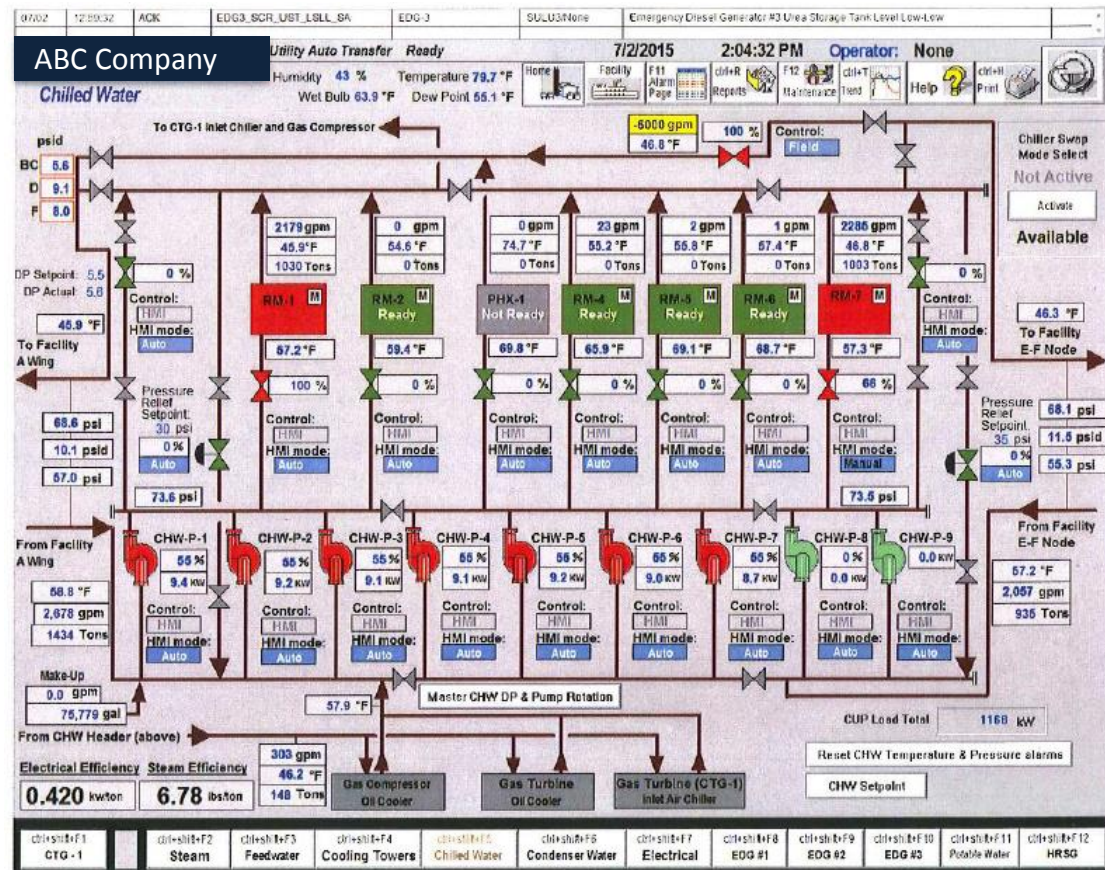


CHW Pump Savings

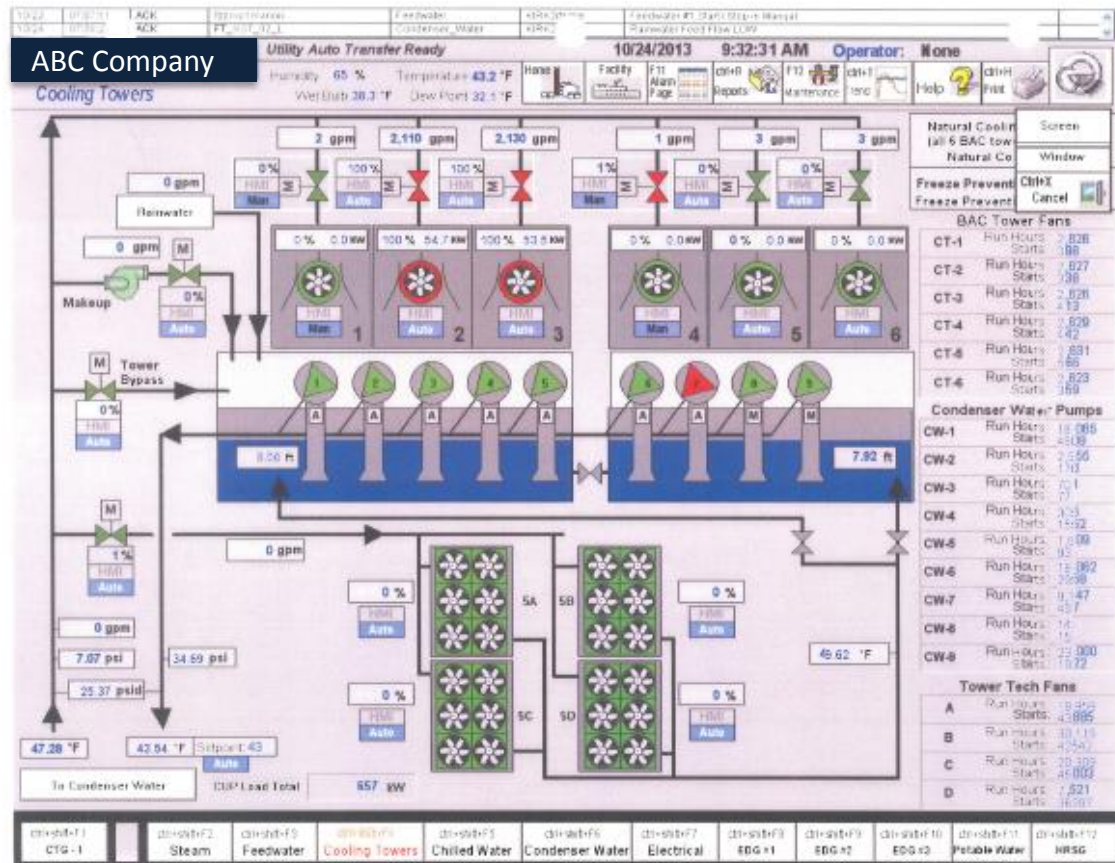
Shoulder Season with Two Chillers On Line – Base Case



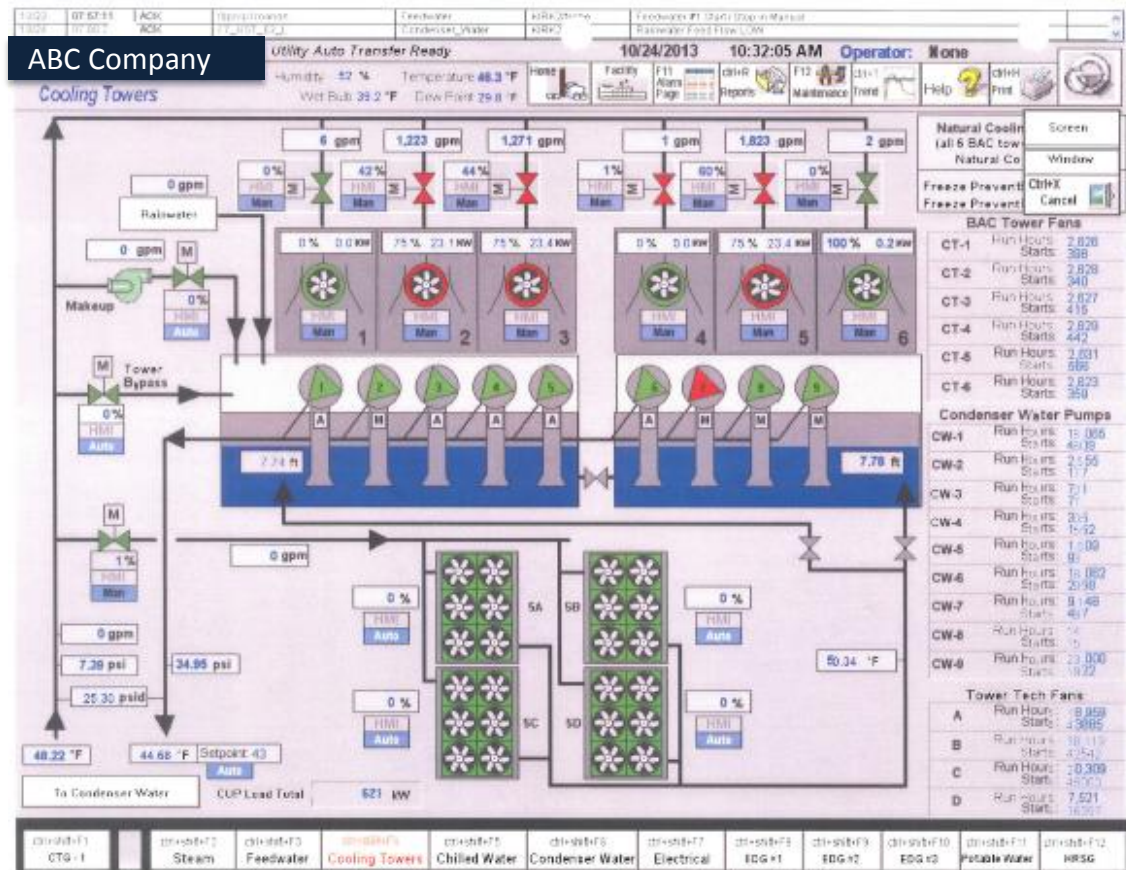
Shoulder Season with Two Chillers On Line – Revised Case



Shoulder Season – One Chiller On Line – Base Case

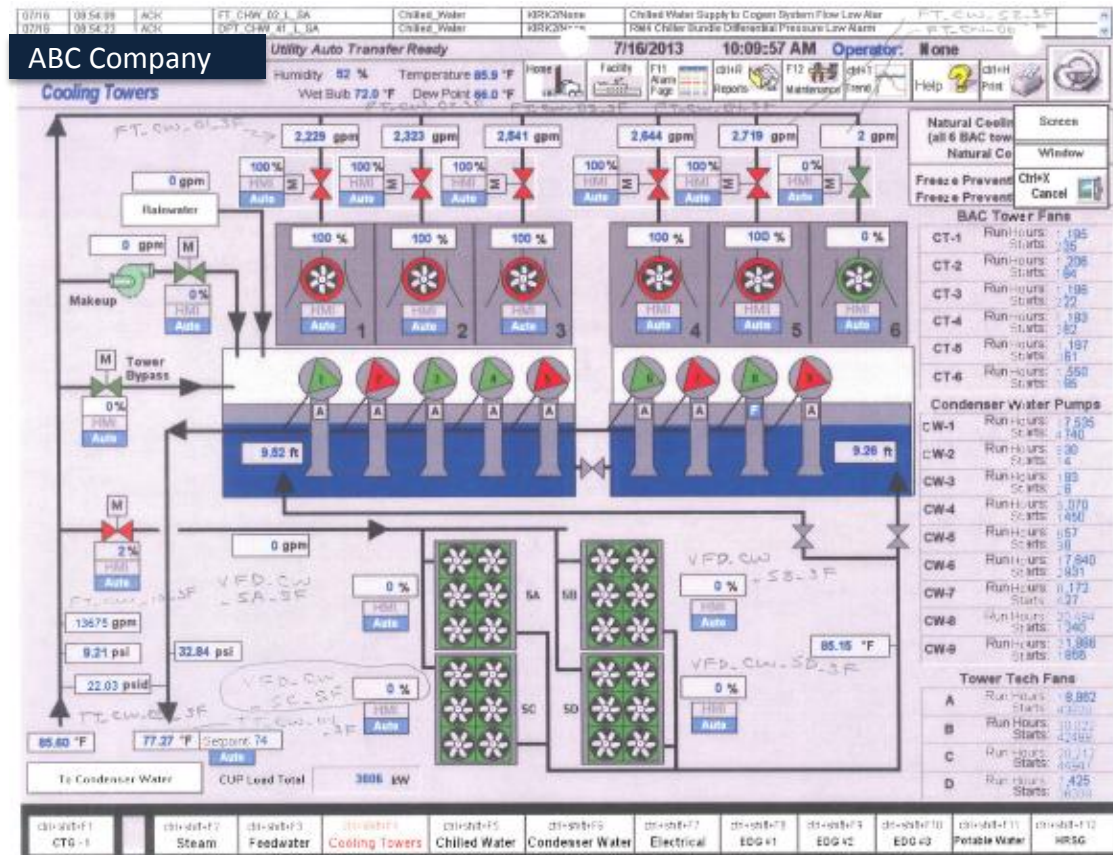


Shoulder Season – One Chiller On Line – Revised Case



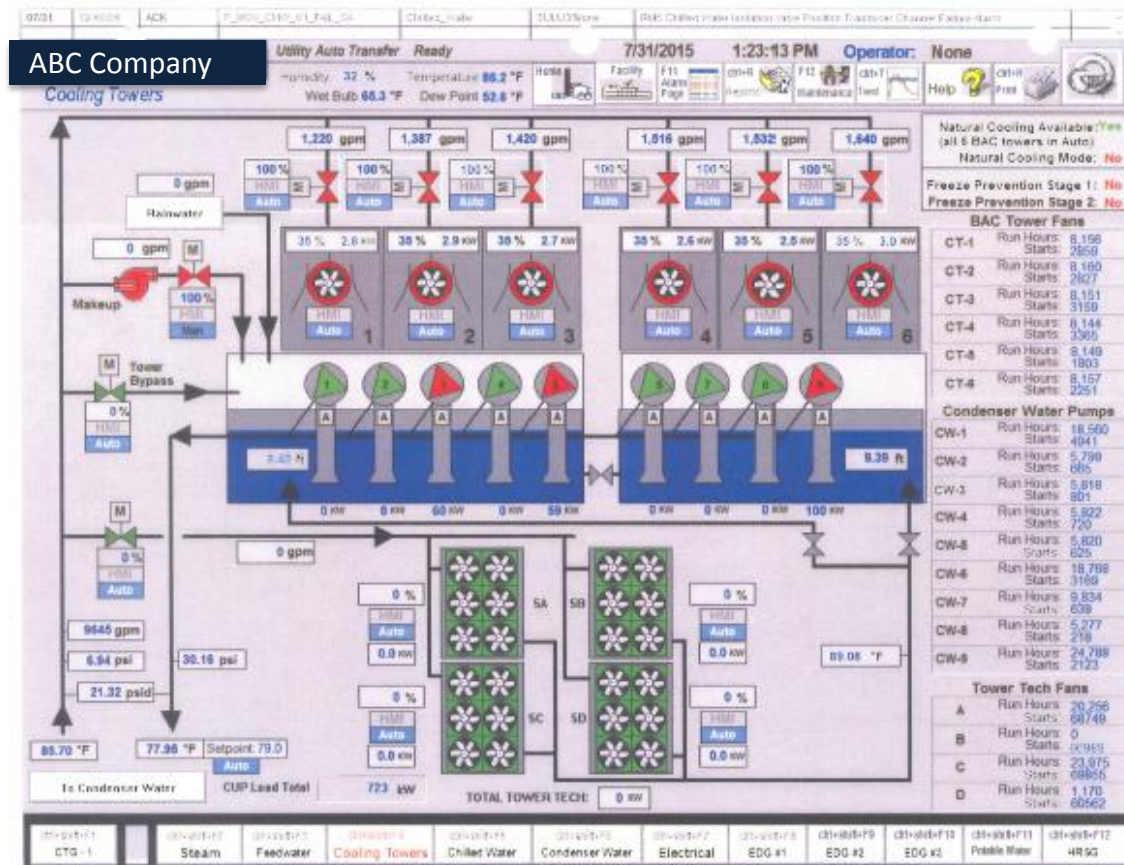
Cooling tower sequence improvements

Summer Season – Multiple Chillers On Line – Base Case



Cooling tower sequence improvements

Summer Season – Multiple Chillers On Line – Revised Case



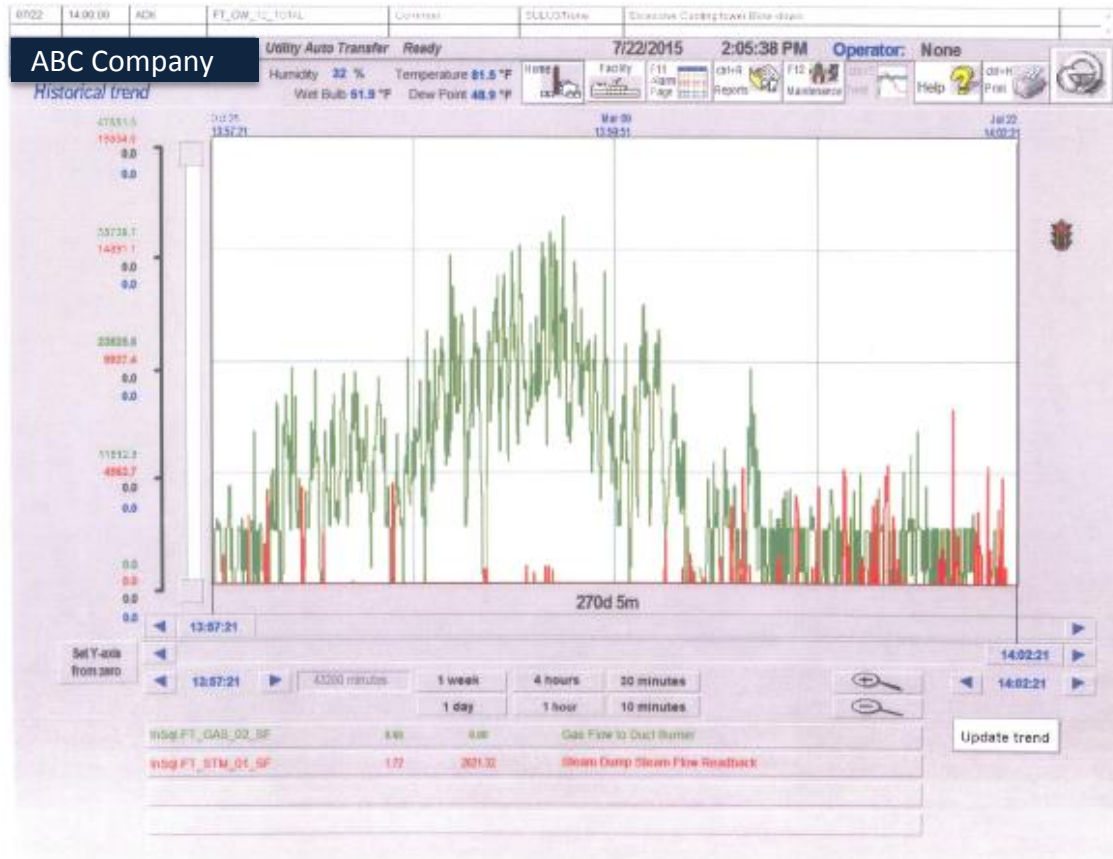
Not chilled water related

Simultaneous operation of the steam dump while duct firing



Not chilled water related

Steam dump and duct burner interlocked





Savings

Cooling tower sequence	\$104,000
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Chilled water pumping	\$ 61,000
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Reset schedules	\$ 59,000
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Free cooling	\$ 39,000
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Duct burner control	\$ 23,000
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TOTAL	\$286,000
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Summary

- ◆ No two situations are alike
- ◆ Client had the tools
- ◆ The ability to adequately manage water
- ◆ Free cooling capability during the winter
- ◆ Single VFD chiller operation for extended periods
- ◆ Minor upgrades were required
 - ❖ Relocation of DP sensors
 - ❖ Addition of three VFDs
 - ❖ Updated programming
 - ❖ Operator training
 - ❖ Ability to track auto versus manual
- ◆ Project ROI of .3 years
- ◆ Avoided capital cost of \$900K

Next steps

- ◆ Monitor and trend system performance
- ◆ Program guidance for chiller staging
- ◆ Evaluate savings associated with additional VFDs

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