THE POWER OF EFFICIENCY

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ACCS

Automatic Condenser Cleaning System

CASE STUDY

Five star hotel in Delhi now maintains Chiller Approach temperature efficiently

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Site photographs

THE PROBLEM

- **A five star hotel located in prime location has 4 Nos x 425 TR Water Cooled Chillers to cater their hotel cooling demand.** The Makeup water to the Cooling Tower is from the STP through Softener plant. There was a major problem of increase in Condenser Approach temperatures between the scheduled De-scaling.

THE SOLUTION

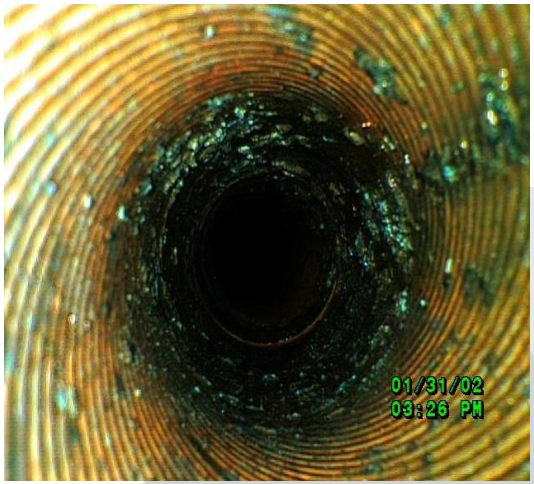
- After a critical evaluation of past chiller data, team CET Enviro proposed ACCS (Automatic Condenser Cleaning System) to the customer on the basis on ROI calculations and the benefits.
- **ACCS can maintain and keep condenser clean and provides crucial energy savings** that were otherwise go wasted due to deposition of fouling in the Condenser.

THE OUTCOME

- **ACCS was installed in the month of March 2016** and since then running well. As per the feedback given by site operators and engineers,
  1. *Saturated Condenser Refrigerant Temperature is now near to Condenser Water Leaving Temperature.*
  2. *No manual cleaning/de-scaling has been performed since the installation of ACCS*

CHILLER LOG BOOK DATA BEFORE ACCS

Chiller parameters of were collected from Logbook starting February 2015. Next slide shows monthly readings of Chillers running close to the set point. Chiller Number 2 has been run continuously through the period, so data of the same chiller is being used for comparison and calculations.



A typical Fouled Condenser tube

CHILLER LOG BOOK DATA BEFORE ACCS

Chiller - 2														
Month	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16
Date	25-Feb-15	24-Mar-15	27-Apr-15	28-May-15	25-Jun-15	23-Jul-15	26-Aug-15	27-Sep-15	23-Oct-15	11-Nov-15	13-Dec-15	25-Jan-16	18-Feb-16	28-Mar-16
Amps	191.7	211	147	324.2	370	330.4	184	215.3	121.2	340.2	235.9	192	231	104
% Loading	50.3%	60.8%	41.5%	85.3%	98	87	48.6	56.6	31.2	89.4	62.2	50.3	60	27.7
Condenser outlet Temp (Deg F)	90.4	88	86.6	91.3	92.3	93.9	89	86.1	82.3	85.8	83.5	84.5	87.2	78.5
Condenser Inlet Temp (Deg F)	83.2	81	82	84.6	84.2	87.1	84.3	80.9	78.6	78.1	79.5	78.5	80.3	73.6
Chilled water Inlet Temp (Deg F)	52.3	52	56.2	55.1	54.6	57.5	52.7	54	55.6	57.4	63.6	56.9	59.2	56.5
Chilled water Outlet Temp (Deg F)	59.3	60.1	50.2	47.8	46	50.3	47.7	47.8	51.6	46.9	55.5	50.7	51.2	52
Chilled water Setpoint (Deg F)	52	49	50.8	47.3	49	46.8	48	49	48	50.2	48	52	54	51
Saturated Condensor Dishargе Temp. (Deg F) (DISCHARGE PRESSURE)	93.9	93	91.9	102.4	122.3	101.8	114	116	101.6	102.9	120	114	122	96.7
Condenser Approach Temp. (Deg F)	3.5	5	5.3	11.1	7	7.9	6.1	8.2	6	17.1	12.5	10.5	12	8.3
Average Condenser Approach Month wise	3.33	3.78	6.43	9.40	5.28	7.58	6.80	8.35	7.73	17.10	11.33	10.90	11.58	11.58
	BASELINE DATA OF CHILLER NUMBER 2 BEFORE AUTOMATIC TUBE CLEANING SYSTEM WAS INSTALLED													

Readings of 4 different days of each month have been used for Analysis

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POINTS WORTH NOTING FROM ABOVE DATA – *before ACCS*

- De-scaling was done twice in one year because of high level of fouling happening in the Condenser tubes.
- Minimum approach achieved after De-scaling was 3.5 Deg F while maximum approach went as high as 12 Deg F.

CHILLER LOG BOOK DATA AFTER ACCS

Chiller - 2											
Month	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17
Date	22-Apr-16	31-May-17	30-Jun-16	27-Jul-16	30-Aug-16	28-Sep-16	27-Oct-16	29-Nov-16	20-Dec-16	19-Jan-71	23-Feb-17
Amps	248	202	354	180	150	212	204	120	236	240	87
% Loading	98	53.1	93.1	47.4	39	55.8	53.5	31	65	65	23.6
Condenser outlet Temp (Deg F)	83.5	85.4	96.2	89.4	86.3	89.3	86	82.7	89.5	85.3	77.5
Condenser Inlet Temp (Deg F)	76.4	80.1	89.5	84.6	82.2	84.1	80.5	78.4	80.1	75.5	73.1
Chilled water Inlet Temp (Deg F)	53.1	52.6	54.9	52.6	52.3	53.5	56.1	56.8	63	67.5	59
Chilled water Outlet Temp (Deg F)	46.8	46.7	47.4	47.4	47.7	47.8	50	52	53.5	56.3	54.4
Chilled water Setpoint (Deg F)	46	50	48	48	48	48	49	51	53	53	52
Saturated Condensor Disharge Temp. (Deg F) (DISCHARGE PRESSURE)	88	105.1	127	110	103	111	105	96.7	112	113	87
Condenser Approach Temp. (Deg F)	4.5	4	4.8	3.8	3.7	4.5	4.3	2.9	4.5	4.5	5.3
Average Condenser Approach Month wise	2.18	4.70	4.98	4.43	4.03	4.63	4.20	3.48	3.38	4.40	4.58
% Additional Savings as compared to previous year same month	6.375	7.05	0.45	4.72	4.16	5.59	5.29	20.44	11.93	9.75	10.50

Additional Energy Consumption is calculated based on the fact (taken from Carrier Chiller handbook) that every 1 Deg F rise in Condenser approach temperature increases the Chiller power consumption by 1.5%.

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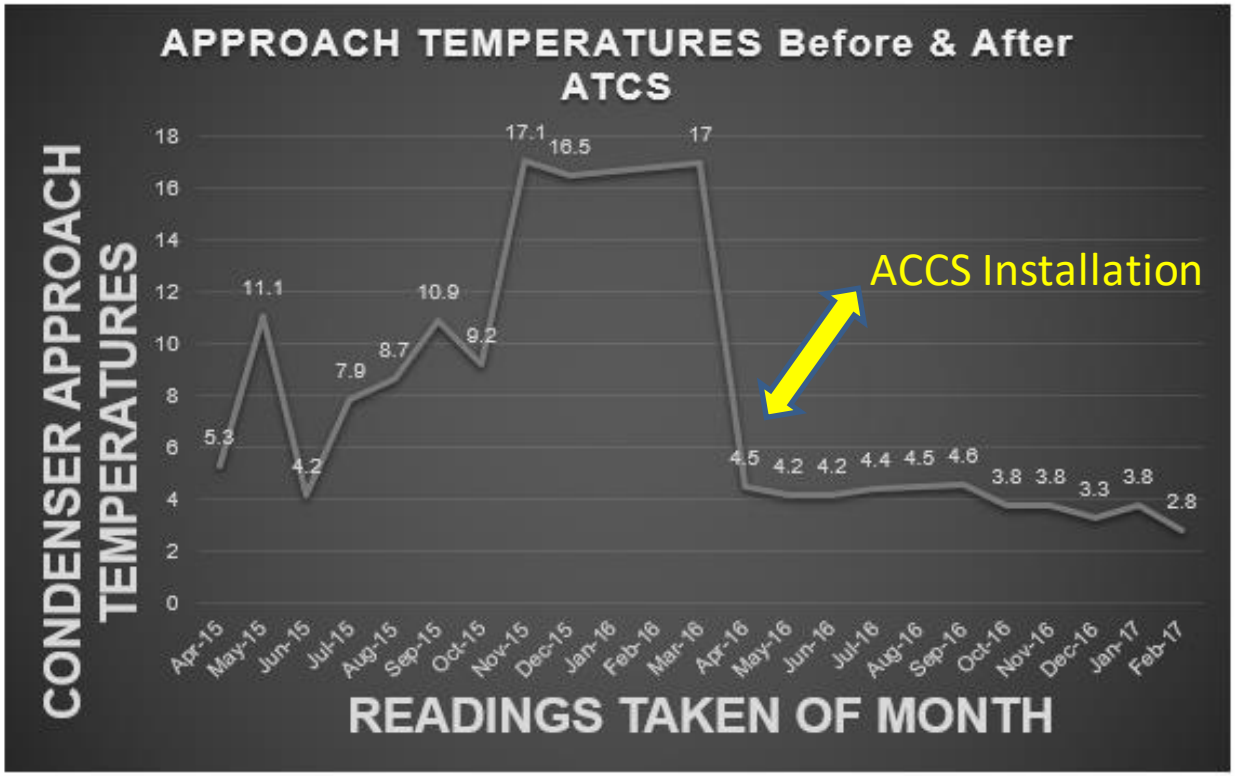
Readings of 4 different days of each month have been used for Analysis

POST ANALYSIS



"De-scaling has not been done since the installation of ACCS and approach temperatures have been maintained throughout!"

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Benefits of ACCS to the customer

- It can be easily referred from the above data that the problem of frequent increase in fouling was solved after installation of ATCS. **The De-scaling frequency which was twice a year reduced to zero in last 11 months of operation.**

The Condenser Approach Temperatures which used to go as high as 12 Deg F during 2015-2016 year of operation is maintained around 4 to 5 Deg F.

Average Energy Savings up to 12% savings has been achieved and the system has recovered its investment cost within 11 months of operation.

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