



# AUTOMATION OF THE COOLING TOWERS USING VFDS TO MINIMIZE THEIR CONSUMPTION

## OBJECTIVE

The work objective is to minimize consumption by automating cooling towers using VFDS.

## BACKGROUND

There are a total of 3 Cooling towers, which were commissioned in 2010 with other HVAC systems. Each cooling tower has a rated capacity of 375 TR and a fan capacity of 20HP each, which runs continuously at full speed for water cooling. While the cooling tower's consumption is fixed, its load varies throughout the year with the peak being during afternoons or in the summer season only. With VFD automation on cooling towers, the consumption can be made variable by modulating speed as per the load. As the cooling is partial for most of the time during the year, it will save a substantial amount of energy while improving the cooling tower's performance.

## SOLUTION

Cooling towers are proposed to be automated as per the ambient conditions and the load. Based on the above, PSIPL performed a detailed energy audit study and proposed a technical solution, while working with a reputed automation solution provider. The findings of the energy audit study suggest that there is a scope of more than 15% energy savings on cooling tower consumption. Wherein the cooling tower's fan speed will be automated based on ambient temperature and output water temperature. And the complete process shall be automated using ambient temperature sensors and water sensors while continuously optimizing fan speeds to achieve the required output. This will require VFDS, PLC, and temperature sensors which will ensure the fan's load varies as per the cooling tower's load. The cost-saving from the project as shown through the audit, conducted by PSIPL, shows an annual energy savings of 22,500 kWh, energy cost savings of 2.8 lacs/annum, and a payback of 2 years. As per this assessment, PSIPL submitted a proposal wherein the solution architecture was designed by PSIPL while working with Schneider as their Automation service partner.



Actual savings based on the readings collected through the Power analyzer are as follows

### CONSOLIDATED SUMMARY

Expected Energy savings as per initial calculations	₹ 248,000
Project cost	₹ 514,000
Initially Expected ROI (in years)	2.1
Daily Energy savings as measured (in kWh)	113
Yearly savings in kWh (for 260 working days)	29463
Daily Monetary savings	₹ 12,726
Annual Energy Savings	₹ 362,395
Final ROI (in years)	1.4



# AUTOMATION OF THE COOLING TOWERS USING VFDs TO MINIMIZE THEIR CONSUMPTION

## PROCEDURE FOR NORMAL OPERATIONS

1. Keep the Mains Incoming switched ON at all times
2. There are 2 modes of operations : "REMOTE" thru BMS and "LOCAL" through push buttons on Panel
3. For normal operations, please keep the selector switch in "REMOTE" mode
4. In REMOTE mode, the cooling towers can be Switched ON/OFF through BMS as it was operated earlier
5. In REMOTE mode, the fan speed will be controlled automatically through the PLC based on OFFSET which is currently defined between 3-5 degC
6. The OFFSET is nothing but required cooling tower approach & the Cooling tower Setpoint-SP is "WET BULB TEMPERATURE+ OFFSET"
7. For any emergency situations, press the "Emergency Push Button" on the panel immediately

## PROCEDURE IN CASE OF BMS BREAKDOWN – LOCAL ON/OFF

1. Keep the Mains Incoming switched ON at all times
2. In case of BMS breakdown, keep the selector switch in "LOCAL" mode and select the "AUTO" option from HMI
3. After switch is set to LOCAL and AUTO option is selected in HMI, the cooling towers should be Switched ON/OFF through push buttons given on the new panel as per the facility's requirements
4. In AUTO option, the fan speed will be controlled automatically through the PLC based on WET BULB TEMPERATURE & OFFSET entered in the HMI
5. For any emergency situations, press the "Emergency Push Button" on the panel immediately

## PROCEDURE IN CASE OF ONE-BY-ONE CT SERVICING & SIMULTANEOUS PARTIAL CT OPERATIONS

1. Keep the Mains Incoming switched ON
2. In case of one-by-one CT maintenance, keep the selector switch in "LOCAL" mode and select the "Manual" option from HMI
3. Now the cooling towers can be Switched ON/OFF through push buttons given on the new panel as per the facility's requirements
4. The cooling tower speed can be controlled using potentiometers given on the panel & the VFD speed can be seen inside the panel on each VFDs
5. For any emergency situations, press the "Emergency Push Button" on the panel immediately

## PROCEDURE FOR LOTO (LOCK-OUT TAG-OUT) OF COOLING TOWER PANEL/FANS

1. Switch OFF the MAINS incoming
2. Keep the selector switch in LOCAL MODE as an added safety
3. Please ensure that the panel is switched OFF and locked by the authorized electrician as per the instruction of FM-Technical or shift engineer
4. Press the "Emergency Push Button" on the panel as a 3rd level of redundancy & safety. Emergency Push button can be released once the LOTO is removed