

Non Implemented Case Study– Energy Conservation Measure

Measure
Improving the condenser performance of air conditioning unit
Equipment
Air conditioning System
Industry / Sector
Food
Year of Implementation
1999
Cost Benefit Analysis
⊖ Type of Measure: House keeping
⊖ Annual Energy Savings: 0.15 lakh
⊖ Actual cost savings: Rs. 0.68 lakh
⊖ Actual investment : Nil
⊖ Payback: Immediate
Implementation Highlights
<ul style="list-style-type: none"> ☞ Very simple and falls under house keeping or maintenance measure ☞ The measure was implemented but savings were not realized due to non-operation of unit due to <ul style="list-style-type: none"> Ⓢ Part of the section of the production hall was shifted to else where Ⓢ Plant employed localized air conditioning instead of using centralized system

Summary

The performance or specific energy consumption of air conditioning system depends upon the performance of condensers, compressors and evaporators.

Performance improvement of the condenser achieved by improving the heat transfer efficiency, which has resulted in significant energy consumption. This has resulted in increased TR generation.

Background

Packing section of food industry has 3 x 60 TR units to provide comfort conditions of the plant. During normal operation of the plant only two are operated.

Water-cooled heat exchangers are used for condenser application. The performance evaluation of the air conditioning system was evaluated by analyzing the compressor, condenser and evaporator performance.

The measurement and analysis of unit # 1 indicated that the power specific consumption is very high. The A/C Unit is generating 40 TR as against rated TR of 60. The following table gives the summary of performance unit.

Particular	Units	Compressor Unit # 1
Power consumption		
Compressor	kW	61.80
Condenser pump	kW	5.37
AHU fan	kW	11.40
Total	kW	78.57
Estimation of TR Generation		
Sensible TR	TR	23.48
Latent TR	TR	17.21
Total	TR	40.70
Specific power		
Compressor	kW/TR	1.519
Condenser pump	kW/TR	0.132
AHU fan	kW/TR	0.280
Total	kW/TR	1.931

The A/C unit is consuming more power and at the same time generating low TR. The major factors contributing for poor performance are:

- Ⓒ High water inlet and outlet temperatures of condensers due to scale formation and choking of the condenser.
- Ⓒ High water temperatures resulted in high delivery pressures of the compressor and thereby compressor is consuming more power
- Ⓒ Every 5.5°C increase in condenser water temperature, the refrigeration capacity will be reduced by about 6%.
- Ⓒ The measured average water inlet and outlet temperatures of condensers are 35.9°C and 40.2°C respectively. (While the measured temperatures other A/C unit are 31.8°C and 35.9°C)

Proposal:

The improvement in performance of unit # 1 will result in substantial energy savings. The performance of the system can be improved by cleaning the condenser.

After cleaning the condenser, cooling tower performance should be verified for optimum range (4-5 °C) and approach (below 4 °C)

The implementation this measure will results in reduction water temperatures at least by 5°C. Every 1°C increase in condenser water temperature, the refrigeration capacity will be reduced by about 1%.

Plant had implemented the measure and found that savings were achieved at par with the estimation. But the plant couldn't operate these units due changes in the productions shop.

Techno-economics:

Power consumption in the compressor	: 61.8 kW
Minimum reduction in Power consumption	: 3 kW
No of operating hours	: 5000 per year
Annual energy savings	: 15000 kWh
Value of savings	: Rs. 0.68 lakh
Investment	: Marginal
Simple Payback Period	: Immediate

Principle

Every 1°C increase in condenser water temperature, the refrigeration capacity will be reduced by about 1%.