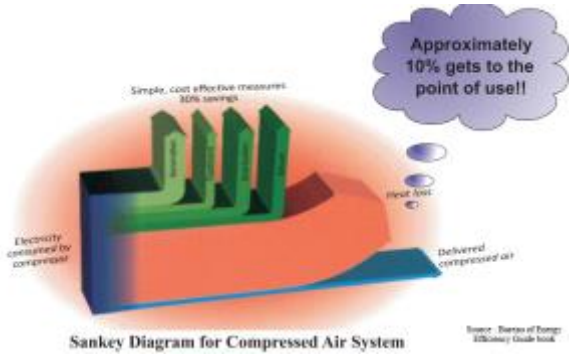
Technical Bulletin No 3 - Waste Heat recovery from Air compressors

Green Company Rating System

13 April 2020

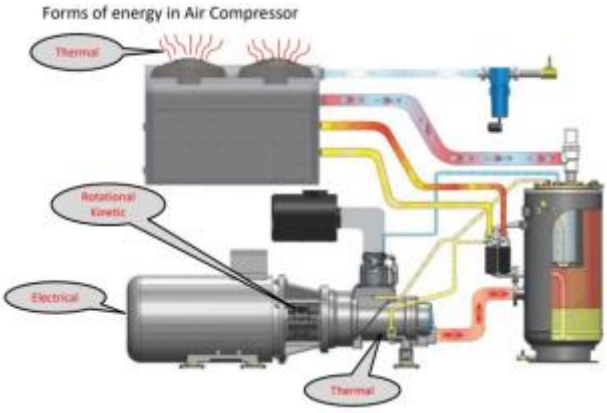
Air Compressors accounts for significant amount of electrical energy in Indian Industries. Only 10- 30% of energy reaches the end user, remaining large amount of electrical energy 70 - 90 % is getting wasted in the form of heat. If not recovered this heat is dispelled into the atmosphere.



1 - Sankey Diagram for Compressed Air system

Compressors are widely used in industrial applications to compress air from ambient conditions. Compression is either by piston type or screw-type compressors, whereby the air molecules are squeezed, consequently increasing the compressed air temperature up to 60°C. The friction also increases the lubrication oil temperature as high as 80°C, which must be cooled down for efficiency.

The heat generated during the compression process, If not recovered, is dispelled into the atmosphere. Sadly, the waste heat from the compressor is released to the atmosphere by an open/closed cooling tower or where not available can be an air cooler.



2 - Forms of Energy in Air Compressor

Implementing heat recovery system in air compressor eliminates the need for additional equipment required to heat air or water, thereby reducing CO_2 emissions and energy consumption significantly.

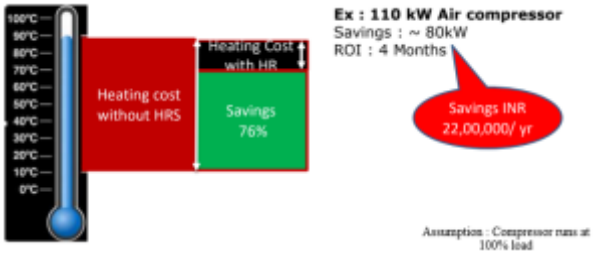
The application is best suited for process industries spanning paper, sugar, food and beverages, dairy, textiles, engineering etc, mainly to companies who require compressed air and use hot water for their process requirements. The same can also be used to preheat the boiler feed water, space heating purposes.

For example, the waste heat recovery unit can sit between the compressor and oil cooler and recovers heat before it touches the cooler. This recovered heat can be used to heat water up to 80 degrees Celsius in most cases.

The return on investment for energy recovery is usually as short as 1–3 years. In addition, energy recovered by means of a closed cooling system enhances compressor operating conditions and utilizing energy more efficiently can lower the CO2 emissions at your organization.

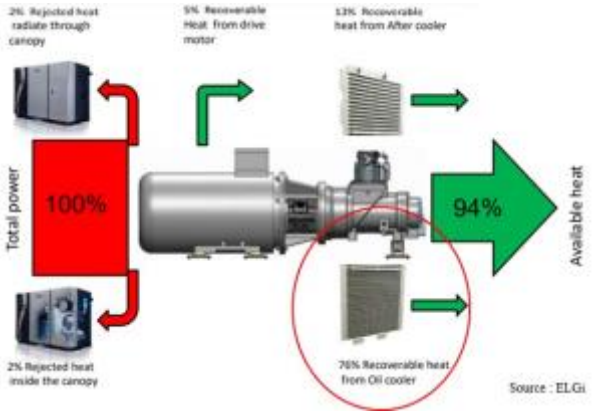
Recovering waste heat from the compressors may offer several benefits

- Energy Conservation
- Reduction in carbon emissions
- Cost savings
- Improvement is the dryness quality of air
- Extended life of power tools
- And if the compressor is cooled with open type cooling tower, would offer additional benefits such as : reduction in the load to cooling tower , water saving , reduction in treatment cost , reduction in electricity cost of elimination of cooling tower fan, etc.



3 - Saving Potential

Saving Potential



4 - Heat recovery potential

As per compressor manufacturer, 76 % of the input energy to compressor will be dissipated has heat, only through oil cooler.

Lets say 100 KW motor driving a screw compressor , out of which 76 kw can be recovered from oil cooler.

Recovering waste heat from the Lube oil is a worthwhile investment.

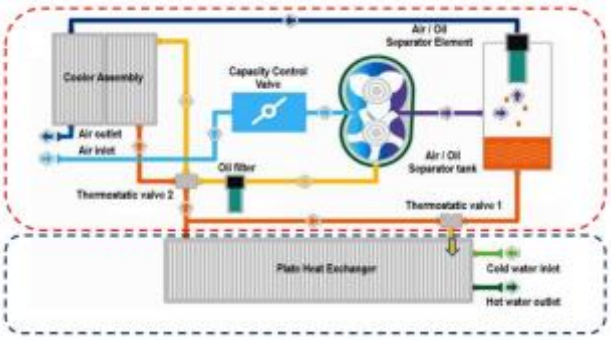
Heat recovery

Oil to heating circuit

Lubricating oil: 95/90/85°C → 65/60/55°C Heating water: 80/75/70°C ← 50/45/40°C

Oil to tap water

Lubricating oil: 95/90/85°C → 65/60/55°C Heating water: 80/75/70°C ← 30/25/20°C



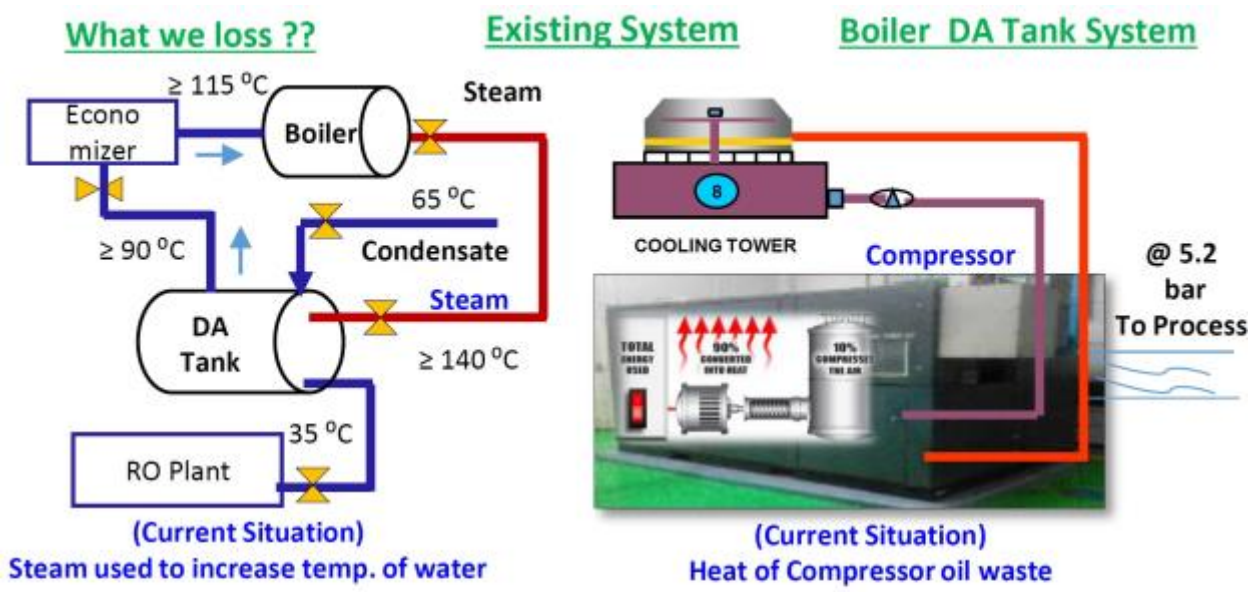
5 - How does it work ?

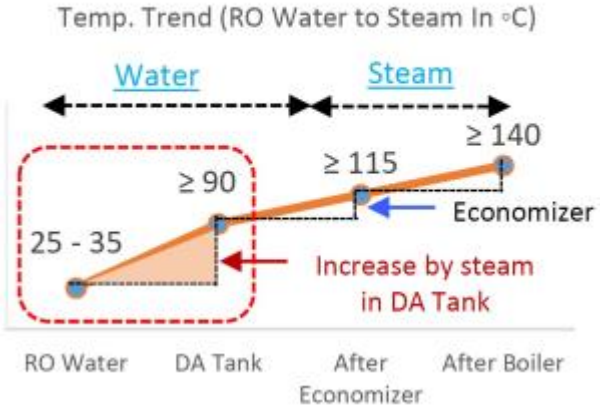
Case Study 1 (Paper Mill)

A paper mill, experienced the benefits of the Heat recovery system, within the first few hours of installation, by way of continuous warm water availability with no external heating. With the implementation, the company was able to recover a heat load of ~ 89.14 kWh / 0.077 MKcal through the continuous water supply of ~2000 lit/hr at a temperature of ~70°C throughout the year. This resulted in an annual energy savings of 800~900 tonnes of LP steam and a carbon emission reduction of ~170-190 tonnes of Co2 / Yr. With the energy efficient compressor and heat recovery system, the company was able to achieve significant energy savings resulting in accomplishing the target stipulated by PAT Scheme and winning the prestigious GreenCo Rating.

6 - Waste heat recovery unit at paper mill

Case study 2 (Auto Industry)



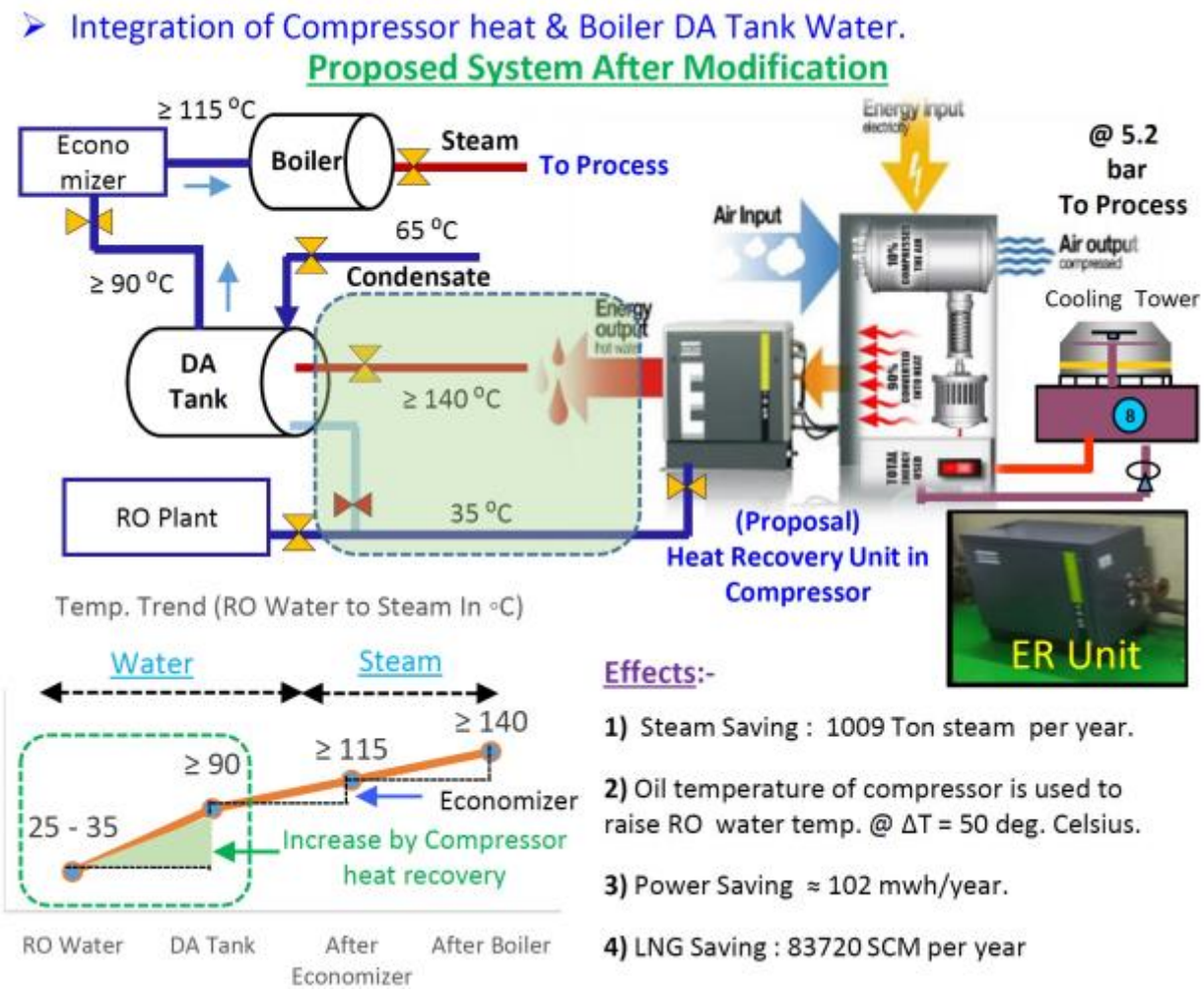


Effects:-

1) Steam Used to raise water temp. : 1009 Ton /Yr

2) Oil Temperature of Compressor : >90˚C is cooled by cooling through CT.

3) 2 Fan of 7.5 X 2 = 15 kwh ≈ 102 mwh/yr waste to reduce oil temp.



8 - After

Sources

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