FLOWNEX®
SIMULATION ENVIRONMENT

COMPRESSOR OPTIMIZATION

This case study reviews an AngloGold Ashanti project which facilitated a saving of 2.5 MW by using Flownex® to optimize compressor and piping systems. The project also won Jean Greyling of AngloGold Ashanti an *eta* (energy efficiency) award.

Jean Greyling, a registered certified energy manager (CEM) holds both a master's degree in mechanical engineering from the North-West University and a government certificate of competency (GCC) for mines and works.

MINING INDUSTRY

CHALLENGE:

The challenge is to optimize components in a system in order to improve the overall efficiency of the system. This specific system is an air-compressor system of which the compressor vane control speed will be studied.

BENEFITS:

- The complete system can be modeled with Flownex®.
- Knowledge of how the system will react under different conditions can be obtained.
- New philosophies can be tested.
- Flownex® can be used to test system upgrades to improve the efficiency of the system which may lead to significant cost and energy savings.

SOLUTION:

In Flownex®, the speed of the vane control and different vane positions of the compressor were simulated in order to investigate the pressure profile to optimize the efficiency of the system.

ANGLOGOLD ASHANTI

"Flownex helped us optimize the compressed air ring and analyze the operating efficiency of the complete fleet. The simulations proved to be extremely valuable in understanding the operating capacity and in addition allowed us to implement a new efficient control philosophy."

Jean Greyling, Energy Manager, Anglo Gold Ashanti

COMPRESSOR OPTIMIZATION

INTRODUCTION

This case study reviews an AngloGold Ashanti project which facilitated a saving of 2.5 MW by using Flownex® to optimize compressor and piping systems. The project also won Jean Greyling of AngloGold Ashanti an *eta* (energy efficiency) award.

SYSTEM DESCRIPTION

Flownex® was used to simulate the AngloGold Ashanti Vaal River compressed air network that consisted of several compressors connected with piping infrastructure over a distance of 32 km. The capacity of some of the compressors ranged from 30 000 to 100 000 CFM and the general operating function of these compressors was to accommodate the underground base loads that ranged between 75 and 106 kg/s.

When the consumption exceeded the supply, the ring pressure would be constant up to a point where the reserve was consumed from the reservoir. This resulted in the system pressure dropping, followed by the compressor master controller sending a command for the Moore controller to open the guide vanes. Although the opening of the guide vanes was not a problem during off-peak conditions, it posed a problem in terms of system response during high-peak times. Therefore an optimization was required.

If the surface pressure fell below a certain point, the mass was increased in the shaft columns to build up pressure at the drill points. The shaft columns only had capacity for a certain flow rate and if this flow rate was exceeded, the effect of auto compression would be lost. The reservoir acted as a damper between supply and consumption and the system pressure could be lost if vanes were not opened fast enough (due to the Moore controller responding too slow). This might have led to the starting of additional compressors which would in turn increase the network's energy consumption. In order to address the problem, the speed of vane control could be increased to minimize the pressure lost in the system.

"Flownex is used to simulate pressure changes and compressor performance for the optimization of a system"

OBJECTIVE OF SIMULATION

The objective of the simulation was to simulate different vane positions to assess the pressure profile and the response of the compressors and the ring pressure.

FLOWNEX MODEL

The Flownex model of the system can be seen in Figure 1.

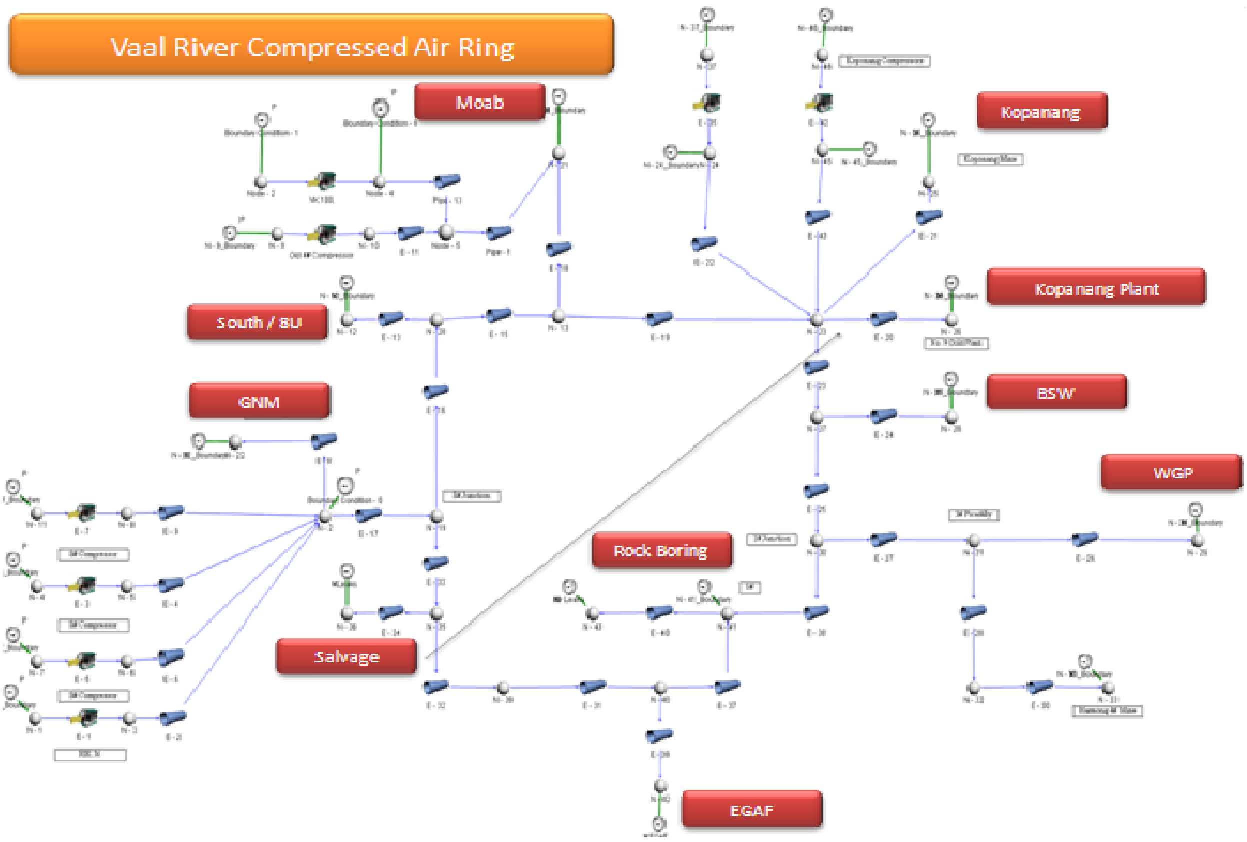

Figure 1: Flownex simulation of the compressed air network.

DESCRIPTION OF SIMULATION

Pipes and compressors are the main elements that were used to simulate the pressure changes and the performance of the compressors within the ring. An iterative solution was done for the proper optimization of vane control speed by using the built-in optimization tool in Flownex®. During the optimization phase, the energy input is minimized to produce the largest amount of air (kg/kWh – optimization).

"Pipes and compressors are the main elements that were used in the simulation to simulate the pressure changes and the performance of the compressor within the ring "

RESULTS

Flownex® allowed engineers to compare energy usage of existing and proposed system configurations. They then expanded the study by simulating multiple operating ranges for more than one configuration. The results showed savings ranging from 1 – 2.5 MW facilitating an annual saving of 24 GWh.

CONCLUSION

The optimization of a compressed air network was demonstrated in this example. By using the built-in optimization tool, an iterative process was used to determine the savings achievable from running different vane positions for the kWh optimization.

The optimization in Flownex resulted in an annual saving of 24 GWh.