Eliminate Leaks in Inert Gas and Compressed Air Lines/Valves (Arc 2.4236)

(The analysis below was extracted from one of the assessment reports by the Clemson University Industrial Assessment Center (IAC). This is only an example recommendation and hence, not all the background information and sources for numbers are included here.)

Est. Electric Consumption Savings	= ***56,940 kWh/yr***
Est. Electric Consumption Cost Savings Est.	= ***$3,985.8/yr***
Electric Demand Savings	= ***78.0 kW/yr***
Est. Electric Demand Cost Savings	= ***$670/yr***
Est. Total Cost Savings	= ***$4,655.8/yr***
Est. Implementation Cost	= ***$2,080***
Simple Payback Period	= ***5.4 months***

Recommended Action:
It is recommended to seal the 4 identified air leaks in compressed air lines.

Background:
The plant has two 25 HP Ingersoll Rand SSR air compressors which are rated for 100 CFM. The assessment team identified 4 air leaks around the compressed air lines across the facility. There is an opportunity for savings in electricity demand and consumption if the plant decides to fix these leaks. The plant operates 8760 hours per year and is charged $0.07/kWh for electric consumption and $8.59/kW for electric demand.

Anticipated Savings:
The assessment team identified 4 air leaks around the compressed air lines across the facility which add up for about 10 CFM blown off compressed air. The compressor voltage was 460V and the power factor of the motor is likely to be 85% and the current flowing through the compressor was 96A. The current power capacity of the system can be calculated as follows:

$$Power = \frac{\sqrt{3} \times Voltage \times Current \times Power\ Factor}{1000\ \frac{W}{kW}}$$

$$\boldsymbol{Power = \frac{\sqrt{3} \times 460V \times 96A \times 0.85}{1000\ \frac{W}{kW}} = 65\ kW}$$

The air compressors are rated for 100 CFM. Fixing the entire air leaks would relieve the system of 10 CFM. By assuming an approximately linear relationship between power and

the flow we can estimate the power reduction due to relieving the system of 10 CFM.

$$Power\ Reduction = Current\ Power\ \times \frac{Air\ Leaks\ Rate}{Air\ Compressor\ Rate}$$

$$\boldsymbol{Power\ Reduction = 65\ kW\ \times \frac{10\ CFM}{100\ CFM} = 6}$$

The annual *electric consumption savings, ECS*, is then the *Power Reduction* multiplied by the hours of operation.

Electric Consumption Savings (ECS) = Power Reduction × Hours of Operation (ECS)

= 6.5kW × 8,760 hr.

ECS = 56,940 kWh

The annual *electric consumption cost savings, ECCS*, is the following:

Electric Consumption Cost Savings (ECCS) = ECS × Electric Rate

$$\boldsymbol{ECCS = 56940\ kWh\ \times \frac{\$0.07}{kWh} = \$3985.8}$$

There will also be an electrical demand decrease as the required power for running the air compressor will decrease after fixing the leaks. The annual *electric demand savings, EDS,* is the following.

Electric Demand Savings (EDS) = Power Reduction × 12 months/year

$$\boldsymbol{EDS = 6.5\ kW\ \times 12\ \frac{months}{year} = 78\ kW/year}$$

The annual *electric demand cost savings, EDCS*, is the following:

Electric Demand Cost Savings (EDCS) = EDS × Demand Rate

$$\boldsymbol{EDCS = 78\ kW\ \times \frac{\$8.59}{kW} = \$670}$$

The annual *total cost savings*, *TCS*, can be calculated as follows:

Total Cost Savings (TCS) = ECCS + EDCS

TCS = $3,985.80 + $670.02 = $4,655.8

Implementation Cost:

To facilitate identifying and repairing air leaks we recommend purchasing an ultra-sonic leak detector and establishing a bi-weekly or monthly preventative maintenance program to identify and fix compressed air leaks. Ultrasonic leak detectors can be purchased for about $1000. We estimate it would take about three hours per month to identify and fix leaks in the compressed air system. Plant personnel indicated the labor rate to be $30 per hour. Therefore, annual labor cost would be about:

$$\frac{\$30}{hour} \times \frac{3\ hour}{month} \times \frac{12\ month}{year} = \frac{\$1080}{year}$$

Therefore, the implementation cost, IC, can be estimates as

Implementation Cost (IC) = $1000 + $1080 = $2,080

Simple Payback Period:

The simple payback period*, SPP*, is the time required to pass before the estimated total cost savings equal the estimated implementation cost, and is calculated by:

$$SPP = \frac{IC}{TCS} = \frac{\$2080}{\$4655.82/year} \times 12\ months$$

SPP = 5.4 months