Reduce the Pressure of Compressed Air to the Minimum Required (Arc 2.4231)

(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	= ***36,407 kWh/yr***
Est. Electric Consumption Cost Savings Est. Electric	= ***$1365 /yr***
Demand Savings	= ***200 kW/yr***
Est. Electric Demand Cost Savings	= ***$4,684 /yr***
Est. Total Cost Savings	= ***$6,049 /yr***
Est. Implementation Cost	= ***$0***
Simple Payback Period	= ***0 months***

Recommended Action:
It is recommended that the operating pressure of the compressed air unit be reduced.

Background:
The plant has two 50 HP Ingersoll Rand SSR air compressors which are rated for an output of 125 PSI and 211 CFM. Only one of these compressors is ever in use at a time. The compressor is currently providing more air than is being used. By reducing the PSI to the minimum pressure needed, the plant can expect to see savings. The compressor operates 2,184 hours per year, with the plant being charged $0.0375/kWh for electric consumption and $23.42/kW for electric demand.

Anticipated Savings:
The plant currently operates the compressed air unit at a higher PSI than required. The unit currently provides 117 PSI to a compressed air powered printer. The printer only requires 87 PSI to operate. Reducing the operating pressure by 30 PSI will bring significant energy savings.

The power of the compressed air unit must be calculated to estimate savings. The operating voltage is 460V, current is 96A, and the power factor is 85%.

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

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

$$\boldsymbol{Power = 65KW}$$

By reducing the operating pressure, we reduce the total time and power spent making compressed air. The power reduction is determined by the following relation:

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

$$\boldsymbol{Power\ Reduction = 65\ kW\ \times \frac{30\ psi}{117\ psi} = 16.67\ kW}$$

Calculating the *Electric Consumption Savings, ECS,* is determined by the following relation:

$$Electric\ Consumption\ Savings\ (ECS) = Power\ Reduction * Annual\ Hours\ of\ Operation$$

ECS = 16.67 kW × 2,184 hrs/yr

ECS = 36,407 kW/yr

Electric Consumption Cost Savings, ECCS, is determined by the following relation:

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

$$ECCS = 36{,}407\ \frac{kWh}{yr} \times 0.0375\ \frac{\$}{kWh}$$

ECCS = 1365 $/yr

Electric Demand Savings, EDS, is determined by the following relation:

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

Electric Demand Savings (EDS) = 16.67 kW × 12 months/yr

EDS = 200 kW/yr

Electric Demand Cost Savings, EDCS is determined by the following relation:

Electric Demand Cost Savings = EDS × Demand Rate

$$\text{EDCS} = 200\ \frac{\text{kW}}{\text{yr}} \times 23.42\ \frac{\$}{\text{kW}}$$

EDCS = 4684 $/yr

Total Cost Savings, TCS, is determined by the following relation:

$$Total\ Cost\ Savings\ (TCS) = ECCS + EDCS$$

$$Total\ Cost\ Savings\ (TCS) = 1365\ \frac{\$}{yr} + 4684\ \frac{\$}{yr}$$

TCS = 6049$/yr

Implementation Cost:
Implementation cost for this will be absolutely zero dollars. Since there is no added maintenance or equipment and only an adjustment of pressure, there is no additional cost.

Implementation Cost = $0

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:

$$SPP = \frac{IC}{TCS} \times 12\ months/yr$$

$$SPP = \frac{\$0}{\$6{,}049} \times 12 \frac{months}{yr}$$

SPP = 0 months