

# COMPRESSED AIR — PART I: REFRAMING SYSTEM IMPROVEMENT COST DECISIONS

Compressed-air systems are essential to many powder and bulk solids handling processes. However, when confronted with compressed-air system issues, instead of tackling the problem and repair costs head-on, many plant managers look for shortcuts even though this can cost more money in the long run. Part I of this article uses real-world examples to detail some compressed-air system problems and discusses how rethinking the costs involved in fixing these issues can benefit your operation.

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**C**ompressed-air systems are necessary in many processes involving powder and bulk solids. The systems are used for everything from powering equipment and transporting material to heating and cooling parts of your process. System components include not only compressors, filters, and dryers but also the piping or ducts, storage tanks, and process equipment that uses or interacts with the air.

While compressed air isn't a glamorous part of your business, tending to these systems and making sure they're operating at their highest potential is beneficial to your bottom line. Often, when a compressed-air system is experiencing issues, plant managers look at the problem and only see an expensive equipment repair or replacement, or they think "I'll get around to that when I have more time." What is less apparent is the money being spent — and sometimes wasted — by continuing to operate these systems inefficiently or at a less-than-optimum level.

Through real-world examples, this article will explain how viewing the costs involved in fixing compressed-air system problems from the right business perspective can help your operation save money in the long run.

## Defining the problem

Several years ago, an audit needed to be done on a coal mine's compressed-air system, as shown in Figure 1. There were three primary places underground and one place above ground that the compressed air went:

- powering belt splicing tools
- driving diaphragm pumps
- feeding leaks
- supplying desiccant dryers (above ground)

The audit found that the majority of improvement opportunities would come from reducing compressed-

air demand and more effectively running the mine's new \$600,000-plus compressed-air system.

The majority of the system's waste was in the dewatering diaphragm pumps. The mine had more than 120 diaphragm pumps, and of the 40 surveyed, 80 percent were pumping dry. Of the 3,600 scfm of air being consumed, 1,500 scfm was going to diaphragm pump waste. When the mine superintendent was told that the operation could save 42 percent (more than \$300,000) of the mine's operating costs with a payback of 18 to 21 months — but that this would require the mine to dig small pits and install a float to control diaphragm pump air consumption — the superintendent said that if holes were going to be dug, they would be "for coal." When possible outsourcing of the digging was suggested, which would still have saved a lot of money, the superintendent said the mine didn't outsource digging.

## FIGURE 1

Installing a new compressor station was avoidable for the coal mine.



If the mine had made the business decision to undertake those costs, the operation could have gone without the new \$600,000-plus system entirely.

So, is the problem the people involved or the process of deciding on a solution? Rest assured, the problem is the process. A dollar saved in a compressed-air system improvement isn't treated the same as a dollar earned in increased profitability, and therein lies the challenge — as well as the opportunity — when dealing with these issues.

If you're reading this article, odds are pretty good that your compressed-air system, as shown in Figure 2, offers a larger cost-reduction opportunity than in some other industries. Many businesses working with powder or bulk solids deal with lightweight materials and often in processes that require heat. You can never underestimate a staff person's ability to ingeniously use compressed air to deal with these lightweight materials and heat issues. We call using compressed air in this manner "pneumatic duct taping," so dealing with the compressed-air demand side is far more critical in your plant than in most. Unfortunately, most compressor experts spend the majority of their time in the compressor room, which means that solutions to compressed-air problems aren't optimal. This is because the system is driven by the compressed-air users and not the compressor room, which is counter-intuitive to what many people think. The compressor is always acting in response to what happened out in the plant. Fixing the problem in the compressor room is similar to letting the tail wag the dog.

## FIGURE 2

Compressed air's versatility makes it an expensive but favorite "go to" in the powder and bulk solids industry.



## Postponing projects can be costly

Plant managers often think they'll get around to compressed-air issues when they have more time, but is that good business? Does the savvy plant or production manager accept unnecessary and avoidable spending? Of course, the answer to this is typically no, but that's not always the case when compressed-air systems are involved. Could this be the case for your facility?

Another example involves a plant that had been talking about conducting a compressed-air system audit for 15 years. Eventually, the plant's financial "pain" became so great that the manager finally decided to have the audit done. After it was completed and the suggested compressed-air improvements were made, the facility ended up saving \$1.1 million per year on a system that cost \$1.6 million per year to run.

This waste doesn't just apply to operating costs. It applies to capital costs as well. What if you have a pressure problem? Buy a new compressor. What if you have a water problem? Buy a bigger dryer. Purchasing these equipment pieces may be a quick solution to your air system problems, but the costs add up fairly quickly. To paraphrase one of the experts in our business, the profitability of the compressed-air industry is built upon expensive solutions for poorly defined problems.

The problem that plant managers face is a lack of precise financial information on what a compressed-air system costs and what can be done with the system in a cost-effective manner. Every plant has had multiple experiences with compressor companies trying to sell capital-intensive compressors to solve misdiagnosed problems. This can deter a plant manager from doing the economically smart thing.

To illustrate, if a business had a salesperson abusing his or her expense account, the business would have a good idea of that salesperson's spending and how much it should be. This would allow management to take appropriate action. That's just good business. Yet plants often allow an operator to put a \$20,000-per-year air lance in a bin somewhere to keep production going without a second thought. Everyone knows compressed air is expensive, but the lack of precise understanding of how expensive it is, combined with where in the process the additional expense occurs, ultimately leads to an abdication of responsibility.

Such a nondecision and wasted expense can be seen in Figure 3. This area of an industrial facility (outside the bulk solids industry) was quite hot, so operators rigged up a cooling system (see the red arrows in Figure 3) that cost \$36,000 per year in compressed air. Alternatively, air could've been brought up to the area from the floor below with an electric air mover at a

**FIGURE 3**

This homemade cooling system cost the company \$34,000 per year.



capital cost of \$500 and an operating cost of \$1,000 per year. But because these operators tried to fix their issue via pneumatic duct taping, the company was wasting \$34,000 per year.

### Finding the excess costs

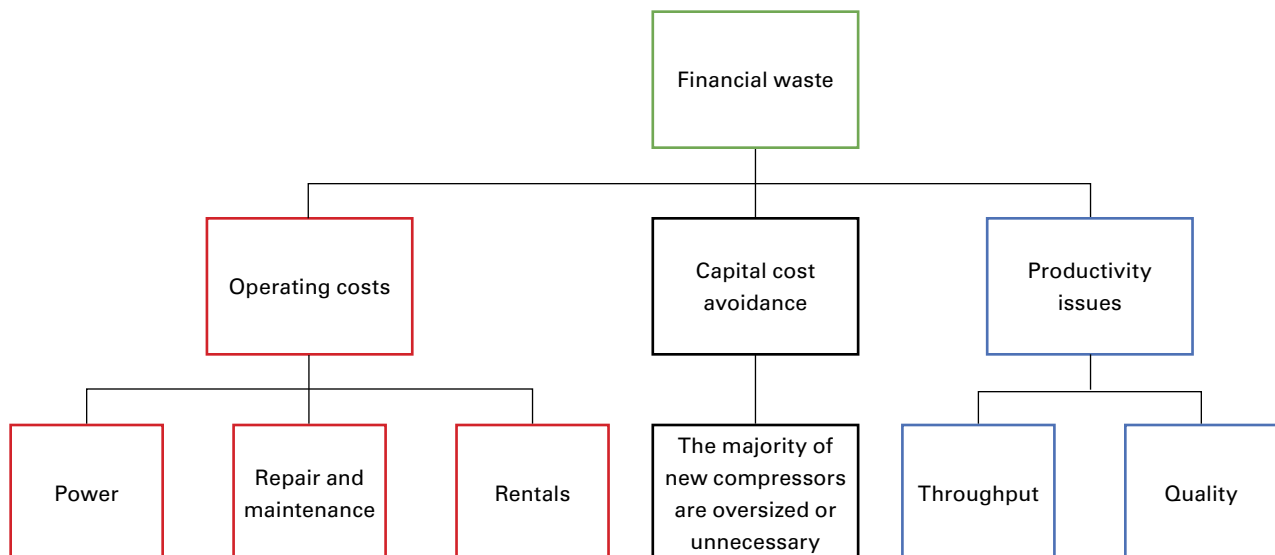
There are three primary areas of potentially wasteful spending within a business: operating costs, capital cost avoidance, and productivity issues, as shown in Figure 4.

**Operating costs.** Operating costs include power (energy), repair and maintenance costs, and rental costs, the last of which may not apply to every plant. Energy is often the focus of compressed-air system improvements, but the solution to this poorly defined problem is to buy a new variable-speed drive (VSD) compressor, right? What the original equipment manufacturers (OEMs) don't always share is that, in many cases, modifying the control settings of the existing equipment can save 50 to 80 percent of that energy without costing you a penny. You already know which is the better return on investment (ROI). Please note, this isn't to say that the VSD compressor isn't the right choice. Sometimes a VSD compressor is the way to go, but the technology is often sold to clients who aren't made aware of all the available options, leading to a poorer ROI.

Repair and maintenance costs are another area of potential savings. Often, plants are tied into OEM service and parts. There's little doubt that the equip-

**FIGURE 4**

There are three primary areas of wasteful spending in a plant's process.



ment manufacturer's service capabilities are generally strong, but often the manufacturer's parts price markup is excessive and the recommendations don't always align with your needs. For example, would you be surprised to learn that there are non-OEM lubricants on the market that last 50 percent longer than the OEM lubricants and cost 60 percent of the price? As a former product manager for a major compressor company, I can attest that there are plenty of non-OEM lubricants you don't want in your compressor. However, there are several that are equal — and in some cases, superior — to OEM offerings.

As another example, there's an industry movement toward more frequent replacement of air ends (which compress the air in rotary screw compressors), with OEMs recommending major overhauls every 24,000 to 32,000 hours on machines that should last up to 50,000 to 60,000 hours. In one United Kingdom-based plant we're working with, staff is replacing air ends on four or five compressors every year because of this OEM recommendation. The cost for that approaches €100,000 (almost \$119,000) per year. However, if the plant were to convert to condition-based monitoring and replace air ends as needed and not on a specific schedule, replacement costs could be reduced by at least 50 percent. If the UK plant adopts the audit recommendations, multiple compressors in the facility will be turned off and the overall maintenance cost for air end replacement will be 10 to 20 percent of the current cost.

Lastly, for those who are renting compressors, especially diesel compressors, as shown in Figure 5, call an independent auditor as soon as you can. Nine times out of 10, these rentals can be eliminated, which can be of massive assistance for a project's ROI.

**Capital cost avoidance.** Avoiding capital expenditures means not making large, unnecessary purchases that ultimately won't help your plant's ROI. Coming across a plant that needs a new compressor or dryer due to capacity reasons is exceedingly rare. In one industry where more than 100 compressed-air system audits were done, exactly zero plants needed additional compressors as long as the plants controlled their existing assets more effectively and eliminated compressed-air abuse on the demand side. Of course, there are cases where machines are old, or a local utility is providing an incentive program where replacing equipment makes sense, but these circumstances are rare. In plants that have multiple air compressors, turning off 10 to 40 percent of the compressors is usually possible without negatively affecting the plant's process.

**Productivity issues.** If you have issues with air pressure or quality, you're likely overspending on compressed-air usage or unnecessary downtime and, therefore, have a high potential for financial return on a project. Compressed air isn't some magical substance. There are rules on how to ensure adequate air pressure and quality at all your system's points of use. What's often not understood are the particular circumstances that led to these air pressure and quality issues. Deter-

**FIGURE 5**

Systems with rental compressors often provide the fastest paybacks of any compressed-air improvement project.



Standard compressor



Diesel compressor

mining these circumstances requires instrumentation and the ability to read and interpret the data.

In one plant, the facility's conveying system had to be shut down on a regular basis due to low air pressure at one of the component's seals. After examining the system, shutdown settings were determined to be too conservative. The circumstances that the shutdowns were protecting against occurred less than 3 percent of the year, yet the shutdowns themselves were occurring weekly. Part of the problem was that this particular part of the process was remote and fed by an undersized pipe. In addition, operators would occasionally operate an air lance, which could drain the air in that local section. The plant learned that some minor changes to its air lance use combined with a better control and shutdown strategy could solve the issue for minimal money.

### Conclusion

Instead of making improvements through discretionary spending, consider making the improvements with ROI in mind while funding the work through a budget that isn't as limited as the maintenance and engineering budget. In most cases, an ROI of two years can be achieved while solving productivity issues. Sometimes the job's ROI stretches out to three years, but not in the majority of instances.

Also consider using an independent auditor in conjunction with your compressed-air equipment supplier. "Trust but verify" is a popular saying that you'd be wise to follow. If a compressed-air equipment supplier believes it's your sole source of advice, then there's almost a certainty that the price of any equipment or service will be higher. In addition, if your compressed-air problem is poorly defined, the probability that your solution will be far more expensive than necessary is likely. **PBE**

**Editor's note:** Part II of this article, which will be published in June's issue, will go in depth on what an air audit entails.

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### For further reading

Find more information on this topic in articles listed under "Compressed air" in the article archive on *PBE's* website, [www.powderbulk.com](http://www.powderbulk.com).

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