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Performance Optimization Tips: The Rules of the Game

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A common impediment to making energy cost-saving changes to systems—even when the change makes sense economically—is securing capital funding approval. In some cases, projects with simple payback periods of less than a year go unfunded because of cash flow constraints, bureaucratic hurdles, competing demands for human and financial resources, and a plethora of other reasons.

But it is an interesting fact that when a piece of equipment breaks and takes a process down, repair funds are almost always available. After all, what's a $20,000 repair when it's costing $10,000 an hour in downtime? Plant operating practices may vary widely, but the availability of maintenance funds in a crisis is a standard. It is, in essence, a rule of the game.

Maintenance: A Defensive Strategy

In football, the general goal of the defense is to stop the other team's offense as quickly and with as little damage as possible, and get their own team's offense back on the field to try to score points. A critical element of defense is becoming very familiar with the opponent's offense. When the defense recognizes weaknesses and tendencies in the offense, they can employ defensive schemes that are likely to create turnovers, thereby establishing good field position for their offense, and occasionally scoring themselves.

Maintenance work is like playing defense-repair the problem as quickly as possible and get production (the offense) back on line to make money (score points). But if weaknesses in the offense (production) are recognized ahead of time preparations can be made. Then when the defense (maintenance) is called in to play, they can not only get the offense back on the field, but might also score points (reduce operational costs) themselves. Let's call it a maintenance contingency modification (MC mod) scheme.

Strategy in Action

Let's assume we have a 100-hp vertical turbine pump with six stages. Our review of the application indicates that the pump develops 40% more head than is currently required. The excess capability is due, in part, to an overly conservative original design, but is also the result of process requirements that have changed with time. This 40% excess head directly translates into 40% excess energy cost.

We find a pump that is better suited to the current needs. Estimating purchase and installation costs to be $20,000, a 2-year payback period is calculated (8000 hrs/yr operation at $.04/kWh). Although this meets the general criterion for energy-reduction funding at our plant, a cash flow crunch has halted funding of projects such as this one.

But 2 months later, the pump shaft seizes, requiring pump removal to make the repair. One of the pump mechanics recalls the suggested change discussions, and makes an alternate proposal. He suggests removal of two stages (providing a 33% reduction in head and energy) during the repair, noting that the additional time required to make the modification will be, at most, a couple of hours, at an additional repair cost of about $200. (The entire repair cost is $3,000.)

Analysis of the Strategy
In a situation like the one above, the additional cost and risk are so small that even in a cash flow crunch, the decision wouldn't be difficult. But there are other points that are important to draw.

1. Removing two stages doesn't achieve all the potential savings that would come from an entirely new pump. An additional 7% reduction in energy would still be possible. But more than 80% (33/40) of the potential savings are achieved, and at a trivial cost.
2. The return on investment will frequently be greater (the payback period reduced) in MC mods than in the "ideal" fix (in this case, a different pump). In this example, the $200 incremental cost is recovered in 8 days through energy savings.
3. If the failure were severe enough to require pump replacement instead of a repair, a more optimal design might cost less than an in-kind replacement. Even if the new pump costs more, the payback period for energy savings is no longer calculated on the total purchase and installation cost of the optimal pump—it is now the differential cost between the optimal and an in-kind replacement. What was a 10-year payback period might now be 3 months.
4. It is important to include maintenance personnel in discussions of energy-saving opportunities for a variety of reasons. First of all, equipment that frequently requires maintenance has, generally speaking, a higher probability of being an energy waster than equipment that seldom requires repair. Second, if maintenance is aware of a potential energy-saving opportunity, they may come up with a creative alternative, as in this example.

Develop a Maintenance Game Plan

The maintenance organization can be viewed as a preserver of the status quo, charged with playing defense only. But just as the rules allow defense to score in football, maintenance staff can not only keep production on line, they can also score points during production in industrial settings.

If the game plan includes preparation for contingencies, a maintenance problem can be—as when a football team's offense is forced to punt and the kick coverage forces a fumble—a blessing in disguise.