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Performance upgrades — It's time

You have just gotten out of engineering school and landed a job in a production facility more than 30 years old. You are mesmerized by the size and horsepower of the plant equipment that runs 24/7. As an engineer you are amazed some of the equipment runs five years before it is serviced. But one thing really bugs you. What about the efficiency of all this old equipment? With all the new technology in the world, what about the technology at your facility? Reliability groups are touting how they have increased the run time between failures, and that's good, but the old technology still bugs you. There are many performance products that improve trucks and autos in horsepower and efficiency, leading you to wonder about both the process and mechanical efficiency of what is running.

Any combination of high with old technology is a formula for failure. Large production-scale plants with the latest technology are going on line in Asia and the Middle East that have the latest technology, lower feedstocks and cheaper labor. To compete, it's necessary to upgrade existing facilities' process and mechanical equipment.

Process equipment has great opportunity for improvement, and assessments can be made through the evaluation of energy loss due to detrimental localized effects caused by poor heat transfer and flow distribution. These effects can be studied by evaluating the fluid dynamics including heat and mass transport in local areas. These may include the performance of tower trays, heat exchanger inlets, agitator performance — the list is almost endless. Mechanical equipment could include items like impeller changes in compressors and pumps. It could also involve blade changes in axial turbines and through "debottlenecking" or increasing production rates. While these are good, the focus here is mainly the local effects in equipment.

A methodology for approaching these questions is:

1. Select a production unit suspected of lower process and mechanical technology. Ask what the return on a 5-10-percent increase or more in production using the same energy would be and what that would mean to the profitability of the unit. A reliability, availability, maintainability and safety (RAMS) analysis will aid in determining what needs to be looked at. This analysis addresses all aspects that affect the operation of the equipment.

2. Establish a target performance level that is reasonable. Items might include reliability or process performance. Determine how meeting the expectation will impact the facility's bottom line.

3. Once the equipment is selected and it is believed a payout of any modification will be approximately one year, a preliminary analysis needs to be conducted to address all the technical issues. Perhaps a first pass hazard and operability study needs to be performed.

4. Perform a detailed analysis. This will include, but not always be limited to, process, metallurgical, mechanical, controls and environmental concerns. It is better to prove out success in the virtual world rather than the real world.

It is also a good idea to evaluate the unit on a base line basis. This might include a field study to gather detailed data that might be more what is normally available in the process control system. Also check the models against the field data to see if there is a good match. If so, one can move forward with the process. After the analysis is complete, operations, maintenance, materials, engineering and process personnel should be involved in a review.

5. A final economic study should be conducted to see if the return on investment is there.

6. Select vendors through a qualification process to implement the goals and objectives of the project.

7. Perform a decision and risk analysis to determine where the change fits in the overall operation. This will be used as part of the final decision.

Too often we are so focused on reliability that we don't question process performance. Now more than ever the petrochemical industry needs not only reliability engineering groups but performance enhancement teams. All analysis should be done under the direction of qualified professional engineers.

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