

Enhance returns on processing plant investments

Working with an experienced contractor can uncover additional benefits when upgrading an existing unit

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Owners of natural gas processing plants often consider expanding or upgrading their facilities. In some cases, the composition of the feedstock being processed changes significantly. These changes can justify capital investment for the upgrade due to new contracts or changing market dynamics. In other cases, an increase in the volume of the gas processed in the plant provides economic incentive to expand. Regardless of the project drivers, the plant owner must weigh many factors to determine how much or what to expand. These factors include:

- Initial capital investment for the expansion or upgrade
- Time needed to attain full back for the initial investment (through increased volume or more efficient operations)
- Cost of the shutdown while the expansion or upgraded equipment is tied into the current facilities
- Safety issues involved with construction activities as well as subsequent operation of the added equipment.

While expansion and upgrade projects may be the most cost-effective way to handle higher volume or changes in the feedstock, these projects often include significant challenges. The more frequently a plant is expanded and modified, the more challenges will be encountered for the next upgrade. Safety is a key concern along with capital costs and return on investment.

Effective planning. When planning a gas plant upgrade, careful consideration must be given to finding the most cost-effective and safe way to:

- Limit disruption to the existing operations and minimize the time the plant is offline
- Add new—potentially large—structures within the confines of the existing footprint
- Tie new piping into existing networks for maximum efficiency and reliability.

Gas plant owners can benefit from opportunities afforded by an upgrade to solve other problems impeding the unit's efficient operation. For example, if the existing plant is experiencing bottlenecks in certain areas, an expansion or upgrade project may present the ideal opportunity to de-bottleneck the plant and increase production. New capacity can offset the cost



FIG. 1 Gas processing and liquids fractionation plant in the Caribbean.

for the upgrades.

Any modifications that provide greater operational flexibility with little added cost or downtime to the planned upgrade can reduce the time required to recoup the investment. Contractors can be brought into the planning process to help determine the best total solution for the plant. The earlier a contractor is brought into the planning process, the more effective the contributions can be. By planning the project together, the plant owner and contractor can take advantage of the owner's knowledge of the plant operations and the contractor's experience in performing work in a turnaround environment.

Finding time. There is never a good time to disrupt ongoing operations for a project that requires a plant shutdown. However, there are ways that a contractor can help the plant owner minimize the interruption. Lessons learned from previous projects can provide valuable strategies for moving work traditionally handled during the installation phase to the pre-turnaround phase, thus, reducing the time to install new equipment.



FIG. 2 The upgrade to the gas plant in the Caribbean included 230 piping tie-ins.

A recent project involved the upgrade of a gas processing and liquids fractionation plant in the Caribbean (Fig. 1). This project required a total of 230 tie-ins to the existing facility as well as an upgrade to the entire electrical distribution system, which had to be coordinated with the local government (Fig. 2). Despite the complexity of the work and the logistics involved, this job was completed during a one-week shutdown. The work, which was completed on time and without injury, was carefully planned prior to the shutdown and innovative ways were sought to perform some of the work prior to the shutdown. One strategy that was developed during this planning phase was to divert flow from one area to another without impacting ongoing operations. This strategy worked well and allowed half of the tie-ins to be completed before the shutdown started.

Minimize downtime. Another way to minimize the disruption to the plant operations is through pre-fabrication and modularization of the equipment being added. Whether or not this is possible or practical depends on many factors, including the size and weight of the equipment; the transportation options between the fabrication shop and the plant; and the capabilities, experience and resources of the contractor.

Lifting. Highly mobile heavy lifting cranes combined with other specialized transport equipment available have made it possible to lift components that weigh up to 1,000 tons, greatly increasing the practicality of modularization for large upgrade projects. Contractors who have ready access to and experience with such equipment are able to cost-effectively complete much of the work in a shop environment and then transport, lift and set the modules at the site for final assembly. This not only minimizes disruption to the operations, but also significantly improves the safety of the construction process by reducing the work that must be performed on scaffolds and by providing a more controlled working environment.

Transport. Transportation options vary greatly from project to project and must be part of the initial planning. Size and weight restrictions can limit the ability to transport extremely large structures on public roadways and over bridges. However, with sufficient planning, alternate routes can often be found to avoid problem areas, and permits—though expensive—can



FIG. 3 Fabricated equipment in the shop is mounted onto a skid, which is then transported to the site.

be obtained. Rail is also an option, especially when shop and plant are both located close to a railway.

Probably the best transportation option, when it is available, is over water. Ideally, when both the shop and the plant are located close to the water, large structures can be lifted by crane onto a barge and then lifted off again when the barge arrives at the plant. This can avoid added costs associated with obtaining permits for land transportation. To successfully handle transportation arrangements of this nature, though, it is necessary to find a contractor who has the logistics experience as well as the knowledge and capability to plan, stage and execute the work.

Proximity to the sea provided a key factor in the decision to pre-fabricate much of the Caribbean upgrade. In addition to being able to perform the work offsite and avoid disruptions to the plant, this strategy also allowed the contractor to split up the work. Some of the work for the Caribbean upgrade was done in a fabrication shop in Texas while other portions were performed by a local fabrication shop. Local participation added value to the project through the project acceleration that resulted from the division of the work, the employment opportunities provided for local residents, and the benefit to local suppliers and the overall local economy.

An added advantage of fabricating the equipment off-site is that initial testing can also be performed off-site. By pre-testing the equipment before it leaves the shop, less time is spent during the installation and start-up phases with testing activity, which contributes to additional schedule reductions.

Finding space. In the current environment, economic and social factors favor plant upgrades over grassroots construction. A growing problem is finding the space within an existing plant for large pieces of new equipment. This problem is exacerbated when the plant has been upgraded previously, and new equip-

ment has already been added to the existing footprint. Besides finding space for additional equipment, space is needed for the construction work involved with installing the equipment.

Pre-fabrication and modularization of equipment can provide solutions for plant upgrade projects (Fig. 3). With the availability of heavy lifting cranes, even very large pieces of equipment can simply be lifted over the existing equipment and dropped into the available space. Safety is also a factor in making the decision to fabricate equipment off-site when space constraints are severe. A shop environment is easier to control and can provide a safer construction site in certain situations.

Modular construction. In addition to fabrication and modular construction, experienced contractors try to find innovative solutions when performing plant upgrades in facilities where plot space is at a premium. In one recent project with limited plot space and severe access issues, the contractor re-arranged the equipment layout from the initial design to locate the project's process columns, which were the largest equipment items with the longest delivery times, to the most accessible area of the plot. The smaller equipment items were then incorporated into modules built at an offsite location.

Using a closely scheduled plan for both fabrication and installation, the modules were constructed offsite and then shipped to the site in a sequence that allowed the contractor to start work in the least accessible corner of the plot and work his way out toward the most accessible areas using the open plot spaces along the way for crane positioning. The same project also required multiple bays of electric motor driven air-cooled heat exchangers to service the processing requirements of the facility. The available plot space did not allow room for these units and obtaining additional space was not an option. To solve this problem, the air coolers were located on the top level of the interconnecting pipe rack. The delivery of these units was then accelerated to allow their installation as part of the pipe rack erection. This allowed the available space in the plant to be used to the fullest extent possible and also avoided additional equipment as well as construction costs.

Finding solutions. A resourceful contractor can provide plant owners with innovative solutions to problems unique to their facility. Often these solutions can be incorporated into a planned upgrade, reducing the cost of the work and optimizing the efficiency of the plant.

For example, the processing plant in the Caribbean wanted more storage flexibility to solve a shipping problem that had developed prior to the plant upgrade. As ship schedules changed, the plant operators found that they were sometimes

long on one product and short on another at a time when the reverse was planned. If additional piping flexibility was built into their system, they could store any product in any tank, allowing them to make the necessary adjustments to accommodate the changes in the shipping schedules. This additional piping work was added to the upgrade project already planned.

In another instance, a US processing facility—while planning an upgrade—was also looking for ways to de-bottleneck their liquids fractionation plant as it became more difficult for the products to meet the required product specifications. With no additional equipment, a contractor bidding the upgrade project was able to upsize a few pieces of equipment in the upgrade and effectively unload the fractionation plant with little cost added to the original bid.

Other solutions would have required a total shutdown of the existing unit and modifications to the existing equipment, such as a total re-tray of the existing towers with high capacity trays. These solutions were not attractive due to the time that the existing unit would be shut down and the other unavailability effects impacting the whole facility. By combining the upgrade and the de-bottlenecking projects, the solution offered resulted in the minimum number of tie-ins and downtime with no modification to the existing plant and products from both units that met or exceeded product specifications.

Optimizing investments. Cost-effective solutions can be added to upgrade and expansion projects to increase the life cycle and efficiency of the processing plants. By partnering with a contractor who has the experience, resources and capabilities to provide the analysis and the solutions required, plant owners can take advantage of the available opportunities and optimize the investment to maximize future revenues. **HP**

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