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The Top Ten Ways to Get the Best Pilot Plant for Your Buck

By Richard Palluzi

Pilot plants are inherently expensive and time consuming; organizations are always looking for ways to reduce their costs and installation schedule. Here are some of the best ways to make your next pilot plant project the most efficient, effective, fastest, and least costly.

1. Define your program goals in adequate detail before starting. Make sure that it includes your objectives for the unit and prioritize them. Document the objectives clearly and review the document with all interested parties to make sure everyone is aligned. When everyone is not aligned, people tend to push the designer in competing directions, needlessly complicating the design and increasing the potential for rework later in the design process.
2. Look carefully at all alternatives to new construction as this will always be the costliest and take the most time. Common options that might be available include repurposing an existing unit, modifying an existing unit, or contracting out elements of the program to schools or outside research organizations. In some cases, even if the option is available, it may be costlier, more time consuming, or just not the right answer, but an effort should be made to make sure that nothing else that might be advantageous is overlooked.
3. Identify all the key issues and requirements to meet the program objectives. Make sure that the pilot plant design addresses all of these requirements. Review the final design for elements that do not contribute to meeting these key requirements and consider their elimination to simplify the design and operation and potentially reduce the cost and schedule.
4. Make a preliminary or scoping cost estimate and schedule early to identify if there is a gross mismatch between expectations and resources. If there is, then secure additional resources (budget, schedule, people, etc.) or cancel the unit. There is no incentive to waste limited resources on a program that cannot be funded.
5. Develop a detailed design basis for the proposed unit and circulate it to all interested parties to make sure that it addresses all the key requirements and also all of their concerns. It also forces everyone to reach agreement on numerous small points early and so avoid rework later. This is also useful in identifying any needs that have been missed and desires which are not critical that have crept into the design.

Work Highlights

Mechanical

- *Provided consulting support to clients regarding the assessment of Acoustically Induced Vibration (AIV) in high capacity, pressure reducing piping systems. In one case, this involved reviewing work done by others and identifying serious errors that were made. Another case involved revising the engineering guideline standard that a client had been using to simplify it and provide additional details.*

Process Development

- *Provided limited process/ mechanical consulting for novel conceptual design development of a proprietary gas conversion technology in selected areas. Work included support for both a commercial size unit and a demo plant. Also prepared an RFP and assisted in screening of third-party testing laboratory vendors to support resolution of critical technical issues.*

Project Management

- *Provided technical bid conditioning team to assist the owner in selecting the prime contractor for a grass roots chemicals plant located in China. The team consisted of mechanical, materials, machinery, electrical, civil, and instrumentation/process control engineers.*

Safety

- *Concluded support integrated within client's safety and noise NPQC team that has covered a few years. The overall mega-project involved a major "clean fuels" revamp of middle-east refinery.*

6. Make sure you try and get the most experienced pilot plant designer available for the design. Not only will they usually be faster and produce a better design, but they will also be better able to identify and address potential problem areas. They are also more likely to challenge preconceived ideas and suggest less expensive or faster alternatives.

7. Arrange for a cold eyes review of the proposed design by an experienced pilot plant designer. This is more important when the primary designer is less experienced. A cold eyes review allows a broader view of the final proposed design before too much is committed. It also can identify weak areas in the design, riskier approaches, or blind spots.

8. Evaluate the design for potential problems and develop fallback positions. The decision to pre-invest in any of these fallbacks is always difficult. Having a plan, however, lets you more critically evaluate if the extra expenditures now are worth the potential savings later if something goes wrong. Many will turn out to be relatively inexpensive and worth doing.

9. Perform a detailed review of the design for startup problems. This allows you to modify the design to avoid identified startup issues and can save significant time and effort later. Develop a detailed start up plan listing all the necessary steps in adequate detail to allow identifying the resources required and estimated duration. This always helps to both manage expectations and allow the commissioning process to go faster and more efficiently.

10. Develop a realistic final cost estimate and schedule for the unit. It will often be different from the preliminary estimate, particularly if the original estimator is inexperienced in pilot plants, or if the design has been forced to evolve in directions different from envisioned at the time of the first estimate. This allows a final review as to whether or not the unit should progress or if the program, design, or schedule needs to be modified to accept more limited funding. While it's not the most efficient time to realize you have a budget gap, it is significantly less risky than progressing the project and recognizing the issue at a later stage.

For further information on ways to make your next pilot plant more of a success, here are some other references.

Developing Screening Estimates, R.P. Palluzi, *Chemical Engineering Progress*, July, 2011

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Cost Effective Pilot Plant Design and Construction, R.P. Palluzi, *Chemical Engineering*, April, 2000

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Pilot Plants: Design, Construction and Operation, R.P. Palluzi, McGraw-Hill, February, 1992

About the Author

Richard Palluzi is a professional chemical engineer with 40 years of experience with ExxonMobil in research and development, designing, operating, relocating, and managing construction of pilot plant facilities in refining and chemical applications. He is experienced with pilot plant basis development, start-up, troubleshooting, plus management of internal and third-party support for a variety of research, process safety, and environmental areas associated with numerous key corporate programs. Richard was the recipient of several ExxonMobil Golden Tiger and other achievement awards.

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