

Re-Use of Pilot Plants to Meet Consumer Product Feedstock Demands

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At the end of a pilot program, decisions must be made whether to tear out the unit, or retain it for future use. If the pilot represents first commercial implementation of a new process, then retention of piloting capabilities can be an important tool for support of commercial startup. If there is no compelling reason to disassemble a unit, leaving the pilot plant in tact may be the best option, as it may provide a head start on a future process development unit. Here, general considerations for reuse of pilot plants are presented, along with a case study where a decision was made to adapt a unit being idled for possible commercial startup support, to pilot an alternate process undergoing development prior to demonstration of commercial feasibility.

General considerations in Pilot Plant Reuse

Table 1 presents factors to consider in a decision to reuse or adapt an existing pilot to a new process study, vs. building a new pilot. If compatibility between processes is extensive, then significant time can be saved in re-use of a previous pilot, vs. all-new construction. Tubing connections between pilot unit operations are much more flexible than piping for a commercial unit, such that non-ideal layouts can often be accommodated. The value of having a portion of the unit pre-installed and service tested cannot be overstated, as making equipment perform as designed often takes more time at pilot startup than anticipated. Employing the same pilot team for the new unit enhances safety and speeds execution.

Table 1: Benefits & Disadvantages of Pilot Plant Re-use

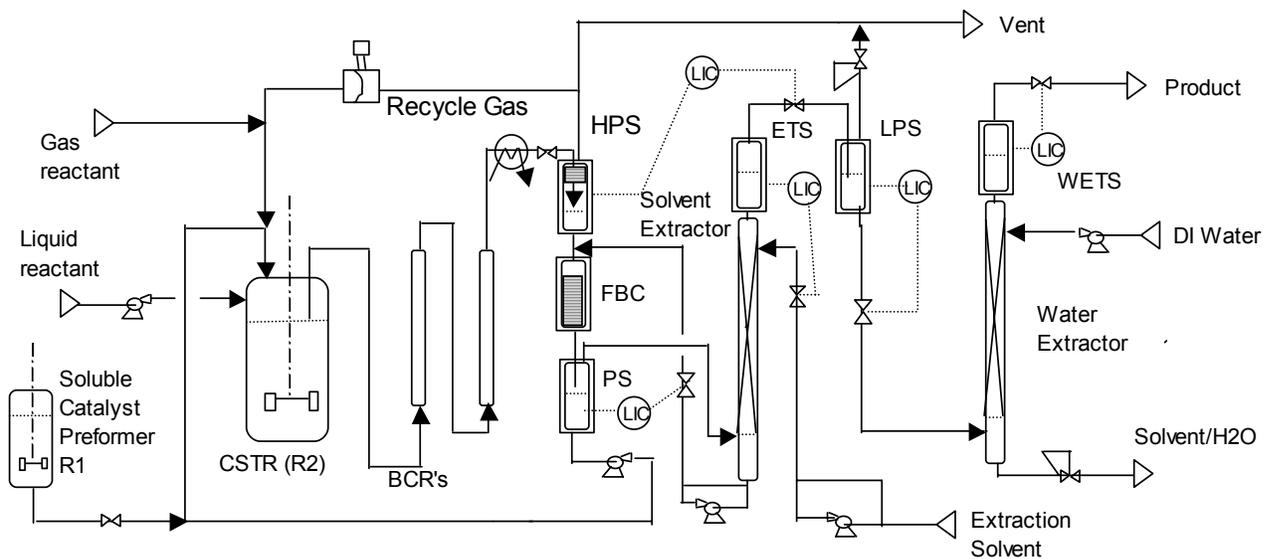
Rating	Consideration	Impact
plus	Reduced procurement time	3 months
plus	Reduced site preparation time	1 month
plus	Pre-tested equipment (portion)	2 wks/unit op
plus	Auxiliary apparatus available	better data
plus	Reduced training requirements	2 wks/unit op
plus	Reduced equipment costs	free unit ops
plus	Reduced installation time	free unit ops
minus	Nonideal layout	ergonomics?
minus	Space availability	new projects
minus	Equipment age and reliability	old vs. new
minus	Instrumentation & Control systems migration	old vs. new

Disadvantages in reuse of pilot equipment, especially after an extended outage, are that better equipment may now be available, especially in the more rapid moving disciplines of instrumentation and control, data acquisition and on-line analysis. If new unit operations are involved, layout issues must be addressed to insure that safety is not compromised.

Case Study: Consumer Product Feedstock Pilot Plant

Figure 1 shows a simplified process flow diagram of the proposed new pilot unit. The feed and reaction sections (3-liter total liquid volume) were to be re-used from an existing pilot operated under similar conditions in the reaction section. Design considerations for the reaction section are discussed in an alternate presentation.¹ Extensive modifications were required in separation and dual extraction sections, such that the original pilot would not be available for commercial startup support, if needed. This risk was taken after much consternation, to accelerate the new pilot program to meet an 8-month window available for process development of the new process. Thus, the back end of the existing pilot was rebuilt in 3 months to allow 5 months of process development study on the new process concept. Normally, 6 – 9 months would be required to procure, build, and start up a new pilot, such that all-new construction would not have consumed the entire window available for new process examination.

Figure 1: New Pilot Concept with Re-Use of Reaction Section



- LPS = low pressure separator
- HPS = high pressure separator
- FBC = filter bed coalescer
- PS = product separator
- ETS = extractor top separator
- WETS = water extractor tops separator

The pilot study was successful in screening the process concept for viability in the 8-month window. Distribution and separation of catalyst system components among the various unit operations led to intermediate compositions that caused catalyst degradation. An operating window could not be found which minimized catalyst degradation, while allowing complete recovery of expensive soluble catalyst. The new process concept was therefore abandoned after 5 months of continuous study, in favor of adaptation of proven technology to the new product development. The latter process was piloted by a third adaptation of the above pilot, which represented the pilot plant's fourth modification in 10 years. Overall, multiple re-use of the facility reduced project costs by about 50%, and doubled R&D staff productivity relative to that which could be realized via all-new construction.

Reference

1. J. B. Powell, "Reactor Scale-down for Pilot Plant, Bench Scale, and Multi-Throughput Units", *AIChE Fall National Meeting*, Nov. 12-17 (2006).