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Dr. Pierre Latour's views on APC

Pierre Latour has been a pillar in our advanced process control (APC) industry for as long as anyone can remember. His long and turbulent career started upon graduating from Purdue University with a PhD degree in 1966. Pierre began his career with operating companies, but became too restless to remain in static positions. In 1971, he cofounded Biles & Associates—quite a successful APC company at the time—although later (after Pierre's departure), it lost direction and disappeared.

In 1977 he left Biles & Associates and cofounded Setpoint, where he was instrumental in overseeing the rise of Setpoint to become one of the major APC suppliers. Pierre surprised us all in 1995 when he left Setpoint to join its fierce competitor: DMC. Shortly after that move, in 1996 AspenTech acquired both DMC and Setpoint, and Pierre was back in the fold, but not in a happy reunion. In 1997 he left AspenTech and became an independent consultant.

Pierre has written a number of papers and editorials about our APC industry.[1, 2, 3] He is an idealist, who would like APC applications to make significant profits for users and suppliers and is utterly frustrated to see the many failures. He and I are not necessarily in agreement about what needs to be done to improve the quality of APC applications, but we both desire to do things right. I asked Pierre to share with *HP* readers what he thought about where the APC industry is going. This editorial is primarily about Pierre's opinion, as my own analysis of what went wrong has only recently been published.[4]

Pierre, can you offer reasons why all of the established APC vendors have not been profitable in recent years?

P. L.: You could say that they do not have good management, and that may be a contribution, but not the underlying cause. Solution providers certainly do not have the right business models. There is confusion between "technology" and "solutions." Operating companies need solutions that perform to create profits, but vendors offer technology tools, components and products.

APC vendors have also strayed from their mission of supplying multivariable constraint controllers. Multivariable predictive controllers (MVPCs) work well and provide value to operating companies. Technologies like real-time optimization (RTOPT), using an LP or QP to optimize large, rigorous chemical engineering models, are corner pickers that take a large amount of resources and do not add much value. There is no well-established way to measure the value of RTOPT. The vendors themselves cannot make money on such applications because they are black holes for labor. Why they have been promoting those dead horses since the 1970s I could never understand. Now the horses have fallen down and trapped their riders underneath.

Going back to MVPC applications, in addition to software packages, APC vendors have teams of APC engineers who configure the application and create the solution, don't they?

P. L.: Configuring an APC application is still not the final solution. The application must work to real constraints and real economics to make money. Vendor companies are so biased toward technology and projects that they do not place proper emphasis on the correct use of APC for sustained profits. Perhaps operating companies are at fault as well. At Setpoint we had always insisted that APC commissioning be done on a reimbursable basis. That was to ensure that the APC engineers did not simply turn the application on and go home. We wanted them to investigate the correct targets and push to obtain the full value of the applications. Operating companies did not like that very much because they could not easily correlate the increased costs to an increase in benefits. The correlation was obviously there, but at that time we did not have the right tools to fully quantify the benefits of improved dynamic performance: reduced variance.

Another point is that technology vendors would never use someone else's technology even if it gives a better solution.

You believe that if only we could correctly identify the incentives for APC and then the benefits—once the application works—that would convince management in a hurry to increase the APC budget. We have read your editorial about CLIFFTENT,[1] but do you think that a tool like CLIFFTENT would improve the quality of applications to the point that they would indeed deliver better value?

P. L.: Sure, once solution supplier and client agree on how to measure financial performance and see the size to be earned and shared, inefficiencies disappear naturally. CLIFFTENT provides a way to take into account risk factors, i.e., accounting for the chances of violating constraints versus the consequence of violating them. It is built on the steady-state profit as a function of the controlled variable mean, which is always a tent-shaped trade-off, sometimes with a discontinuous cliff at the constraint peak.

We make trade-off compromises and take calculated risks every day in industrial plants, and why would that be different with APC? APC is the tool that reduces variance and allows (but not enforces) setting correct targets profitably in the neighborhood of the true plant constraints. To do this right, it is mandatory that we understand the CLIFFTENT economics of risk taking. Without such a tool, operators and APC engineers do not specify the right APC targets. And if they don't, how can APC make money? The assumption that a controller setpoint is properly (optimally) set is one of the failures of our industry.[3]

I have no doubt that if management sees the real value of APC and understands the financial difference between good versus shoddy implementation, it would fund APC to be configured correctly. If suppliers had a stake in the financial outcome, they would too. The benefits are large, but we have to first calculate and second monitor financial value in a way that people would understand and believe.

Once the economics are understood, that creates a driving force to improve the quality of APC applications. With incentives to show profits, engineers would be forced to provide stable applications—working near constraints without violating them. In fact, Zak, you have a business of first-principles inferential models, and CLIFFTENT would easily give plant management the value of a high-fidelity inferential model versus a low-fidelity one. This allows rational judgments about costs: research, implementation and maintenance. The high-fidelity inferential model has higher value simply because, under its smoother control, the plant would be able to work closer to product quality constraints and with fewer violations. Converting smoother operation to visible, provable profits is required to convince management to fund the solution that provides the better quality product.

What would you say was the contribution of RTOPT failures to the decline of APC business profitability?

P. L.: We have had editorial discussions over the years about real-time optimization. We both have agreed that the technology is flawed and the way it is marketed is disingenuous. Eventually the chicken came home to roost and RTOPT has collapsed. The latest on this front is a Chevron engineer's statement at last year's NPRA computer meeting (Q&A session) that he has given up on RTOPT.

First, there is the issue again of people being driven by technology instead of solution performance. Defining economics and accurate response models, especially near constraints, is not a trivial task, and I do not know of any simulation system that handles this properly. And if we cannot accomplish the task, where is the value of such optimization? I would maintain that a knowledgeable experienced engineer, of the type that is needed for working on RTOPT, could guess the right answers as well as any simulation, so why not use that engineer to define targets for MVPCs and abandon RTOPT?

At the risk of sounding redundant, I want to repeat my previous argument about the economics of risk taking. RTOPT is a much more complex environment than MVPC. We need to investigate the entire plant working together to understand how a single unit is to be driven. Until we obtain a correct mathematical representation of an approach to constraints versus violation, what are we to optimize? If there is uncertainty in the model at constraints or economics, then any reasonable solution is as good as any other one.

Next is the issue of the shrinking workforce and experienced pool of operating companies. I suppose management removed many engineers who were unable to demonstrate their ability to identify, capture and sustain profits. The jury is not out yet on whether it was wise to lay off so many knowledgeable engineers, but we cannot ignore the fact that they are gone. Refinery engineers are so busy with mundane day-to-day work that even if RTOPT technology were not flawed, I would have advised my clients not to touch it with a ten-foot pole. There is absolutely no hope that such technology can survive in an average refinery.

Now a few words on RTOPT technology and why it is flawed. Any real-time controller must, by definition, be equipped with dynamic predictive control, but RTOPT does not have any such tools. It is a steady-state device that communicates in an awkward way with the MVPC. "Steady state" it is an imaginary situation that we defined for the sake of comprehension and simplicity, but it never exists in real units. The MVPC has dynamic control tools and an economic optimization model, so it is better suited for optimization then RTOPT. The interface between MVPC and RTOPT is ad hoc and empirical; it clouds any value added by RTOPT.

For RTOPT to work, it must be integrated much better with the MVPC. We cannot perceive of two models and two optimizers working side by side and giving different results. The two must merge into one model and one optimizer. HP

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