

Has the APC industry completely collapsed?

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I stopped writing editorials for a while, because people were uncomfortable reading them, but have finally decided against burying head in sand. We – control engineers – should discuss frankly how APC, being one of the most lucrative refinery projects when done correctly, has lost so much operating companies faith (and funding). Only upon understanding what has gone wrong will we learn how to fix it. In 97 I wrote an editorial [1], pointing to mistakes in the implementation of APC and suggesting that operating companies manage the efforts better and dedicate more engineers for the design stage as well as maintenance.

That has not happened, and now the APC industry is in a state of collapse. Take a look at stock values of publicly owned APC vendors:

	Peak share value	Current share value	Profit (loss) per share
ABB (Sweden)	220	45	0.00
Aspen Tech	55	6	(0.84)
Honeywell	62	36	1.6
Invensys (UK)	350	13	(2.70)

That is not a pretty picture, and if you isolate APC it looks even worse. ABB and Invensys are large conglomerates and their heavy losses are not necessarily related to APC. Judging their APC success in terms of the number of APC engineers, they are a shadow of what they were a decade ago. Honeywell, also a conglomerate, shows better profits, especially now on the strength of its war-support departments, but as far as APC goes, Honeywell closed the Southampton and Thousand Oak offices and shrank the pool of APC engineers substantially. Aspen Tech, the former industry leader, has shed the bulk of its APC engineers in a struggle to recover from a long period of heavy losses. I would venture a guess that the number of experienced APC experts in the world has shrunk to one third of what it was a decade ago. I know of only two (none-public) companies who deliver APC projects profitably and to client satisfaction. Their business model is to work to long term customer satisfaction, even at the cost of incurring a loss on a project. As a result they have much repeat business, low marketing costs and low man-hour rate.

What has gone wrong over the past decade? My 97 editorial can be summarized as follows:

1. Cutting corners to increase revenues

Under competitive pressures APC vendors have reduced their services to cover only the dynamic control core of APC applications. That is not enough. In a live unit there are many incidents when the normal dynamic control logic should be overridden by different logic. This could happen due to erroneous measurements, equipment failures or unusual disturbances. An application that covers only the basic dynamic core would at best lose service factor, and at worst cause a major disturbance and loss of money.

To a considerable degree such corner cutting was encouraged by the clients, who did not appreciate the difference between a well designed versus mediocre

application. The more diligent vendor who wanted to supply a better service at higher price ended up losing the contract altogether.

2. Weak inferential models limit the usefulness of applications

Perhaps the biggest failure of the industry is in the area of inferential models. APC, which makes money by pushing the unit against constraints, moves the throughput (or other key handles) continuously and the unit is never at steady state. Under such conditions the operator is in the dark as to whether product qualities are at targets. Typically lab samples are taken at 6:00 am, results come back at 10:00 am, by that time the sun has come up and unit conditions have changed, and the operator, not knowing how to correct unit conditions, is forced to limit the APC envelope. Thus good inferential models are the prerequisite that must happen in order for APC to make money. When operators trust the inferential models they keep manipulated variable ranges wide open, let the APC application maximize the profit to real constraints and do not mind the absence of steady state.

By and large the industry has adopted a methodology of creating inferential models by regression. There are many reasons as to why regression models are weak [2], suffices to say that regression, or neural network, which is also a form of regression, cannot replace chemical engineering principles.

3. "Pie in the sky optimizers"

APC of a major unit would typically be implemented for \$250,000 to \$400,000, but on-line optimizers could be sold five times that. Why? It is anybody's guess because the optimization technology has failed to demonstrate any value. On-line optimization involves the use of rigorous simulations to optimize the unit, and on paper they look good. I have written one paper[3] and that was followed by a public discussion [4, 5, 6, 7, 8] about the problems of this technology. In the nutshell it is hindered by:

- Lack of procedures for estimating refinery intermediate product prices. Without these, the optimization of a process unit in isolation is meaningless.
- Inability to forecast the quality of feed to a process unit. Incorrect assumption of feed properties yields erroneous results.
- Difficulty of applying steady state models to a dynamic problem.

4. Alliances between APC vendors and operating companies

Not mentioned in the 97 editorial, a new clever business model was promoted in the late 90's. Following project failures, certain operating companies have come up with an idea that if they choose one APC vendor to handle all of their APC needs that would achieve better quality projects at reduced costs. It baffled me how the alliance idea ignored the glaring conflict of interests, but it did, and in the late 90's several alliances blossomed. The inevitable result was a further deterioration of quality. Under a noncompetitive arrangement APC vendors had an incentive to neither provide high quality manpower nor project management efficiency, and the failure rate became astronomical.

That state of irresponsibility has gone on for quite a while, much to my surprise. I thought that a failure rate of 60% would get people's attention quickly, but it took a decade before the chicken came home to roost. When you speak to vendor company

executives the party line is that the industry is crumbling because environmental regulations have taken all the funds and for years nothing was available for APC projects. I believe this is only a part of the story. APC projects used to get funded even when refinery funds were very limited, when people believed that they deliver value, and they stopped being funded when people stopped believing their value.

What shall we do now to recover? I would suggest that the traditional APC vendors would be better off limiting themselves to software rather than applications. In fact, with or without my advice this process is already in motion. The traditional vendor ability to supply high quality APC applications has been adversely affected by the loss of APC engineers and high overhead costs. APC engineers who left those traditional vendors have very successfully set themselves to compete against their prior employers and now this situation is irreversible. The traditional companies who typically own the APC software tools should give their new competitors support and training in the hope to sell more software. That is where alliances should be formed: between software supplier and software implementer.

Further, I would suggest a major effort to develop first principles inferential models. Given the existence of reliable simulations we should be able to develop such models. After all – inferential models resemble “simulation turned on its side”. In simulation the feed and control handles are known, and from that information the simulation computes product qualities and other dependent unit conditions. Whereas an inferential model reads control handles and unit conditions to come up with feed and product qualities. Once such models become available the profitability of APC would not only improve but also become measurable.

This last point about measurability is important. A decade ago people thought that there is no point wasting time on quantifying APC benefits. Today a clear demonstration of value is a necessary step to obtain funding.

References

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