SUSTAINING ADVANCED PROCESS CONTROL BENEFITS WITH DIGITAL TWIN ENABLED PLATFORMS.

Honeywell Forge Profit Performance Monitor

Honeywell

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APC DEGRADATION: INTRODUCTION

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Why does Advanced Process Control (APC) degradation remain such a challenge to overcome in the process industry?

> **A recent survey of APC users found that benefits degraded on average by 30-50% within just 3 years of an APC being deployed. More alarmingly, benefits could be lost entirely within 7 years of APC deployment.**

Advanced Process Control (APC) has been used for decades in the process industry to reduce variability within industrial processes and allow units to operate closer to specified limits. The typical outcomes delivered by a successful APC deployment include increased throughput or yield; and reduced operating costs or energy consumption. The typical lifecycle of an APC implementation can be summarized as:

1. **Pre-APC**: Prior to implementation of APC, the process will suffer from instability and high variability. This variability prohibits operation of the process at the most optimal level for fear of exceeding process limits.
2. **APC Deployment**: On completion of an initial APC deployment, a reduction in variability is delivered, and this reduction is what will allow the controller to operate closer to process limits.
3. **Benefit Maximization**: Once variability reduction is proven, the APC will be tuned to maximize benefit by constantly (and dynamically) calculating and moving to the optimum operating point without exceeding process limits.
4. **Benefit Degradation**: Over time the performance of the APC degrades, resulting in a loss of benefits. There are several factors that cause this degradation that are often difficult to monitor and avoid.

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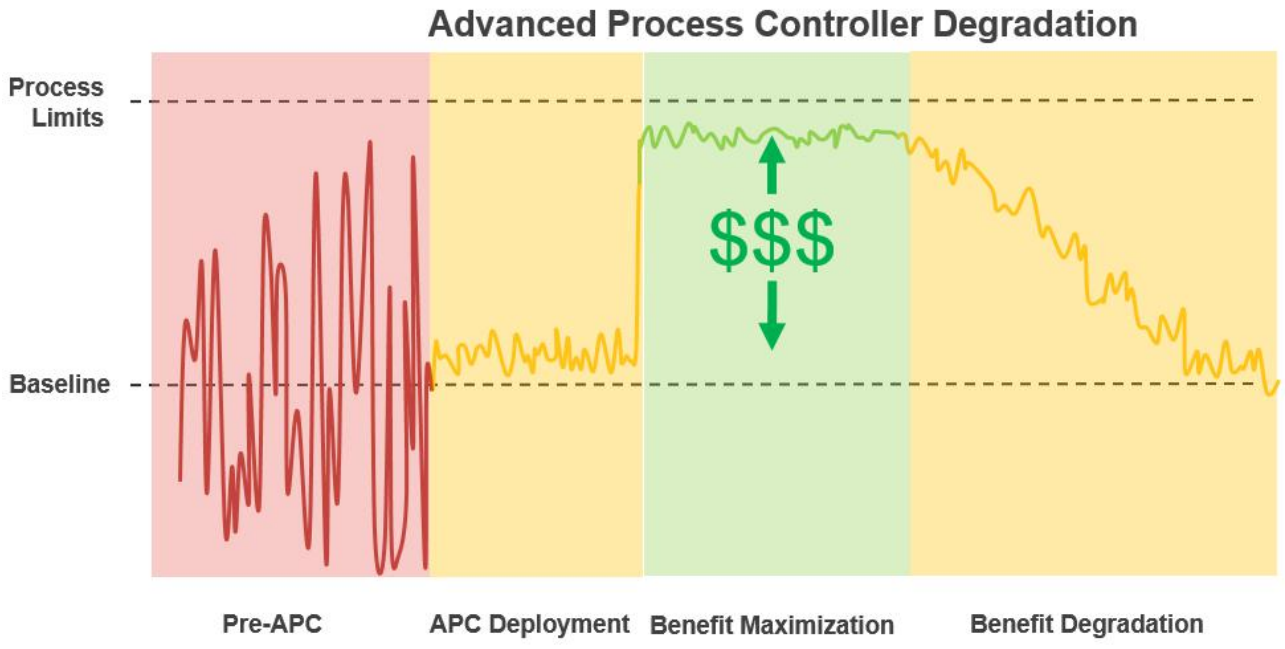

APC BENEFIT LOSS: THE CAUSES

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The causes of APC performance degradation often remain hidden from view and can go unaddressed for long periods of time. This allows for significant degradation and loss of benefits to occur.

Significant Process or Operational Changes

Situations such changes in the availability of feedstocks, changes in the specifications of finished products from end customers, or changes to regulations by governments often result in significant process or operational changes being required numerous times over the life of a typical industrial facility.

These changes, while necessary, often impact the deployed APC application and can result in a loss of benefit due to a mismatch in the predictive model, inferential properties no longer being accurate, or missing manipulated or control variables in the model matrix.

While process or operational changes are traditionally addressed by periodic or scheduled APC remediation, they are often overlooked and result in a loss of APC benefits.

APC Usage Practices

Over time, a deployed APC is not used as it was originally intended within operations teams. This is often caused by a lack of continued training combined with a lack of processes in place to deal with plant upsets, maintenance (including broken equipment and faulty instruments), and changing unit economics i.e. how to run profitably with changing constraints.

Due to the lack of training or standard processes, operators may limit the APC to operate within zones that they deem as safe (but are often conservative), selectively disable manipulated or control variables, turn the APC off entirely, or not return the APC to ideal state after a process upset/maintenance. This leads to a loss of APC benefits, either due to variable performance across shifts, or poor performance across the board.

While APC usage practices are best addressed by regular training and the deployment of suitable processes to address abnormal situations, they can be hard to identify and in most cases, remain hidden from view for long periods of time.

Process or Equipment Degradation

As industrial facilities age, the behavior and characteristics of equipment and other process factors (such as catalysts and reagents) degrade. This results in shrinkage of the process window in which the APC can operate, and can have a direct impact on manipulated or control variable limits.

Although process and equipment degradation issues are best addressed by regular process maintenance, these problems often remain hidden and in many cases, go unaddressed for long periods of time

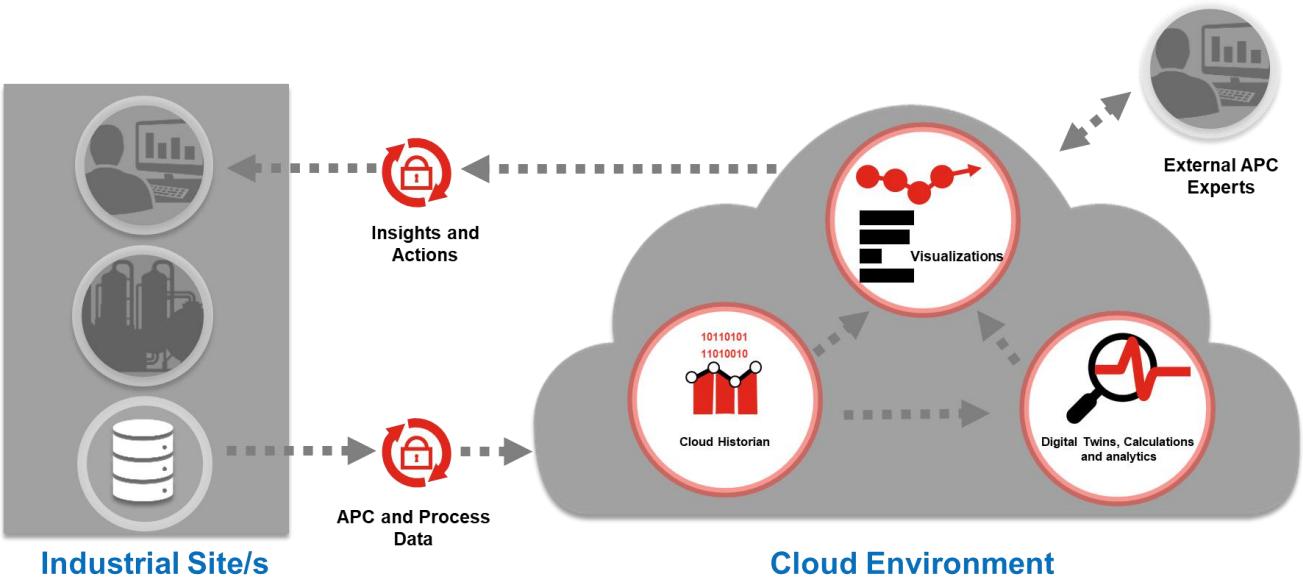
RETAINING BENEFITS WITH DIGITAL TWINS 3

For too long, sustaining APC performance has been the responsibility of the control engineer, but others have a key role to play to ensure immediate and long-term success. These other stakeholders simply require the appropriate tools.

As the responsibility of sustaining APC performance has long been that of the control engineer, the focus of most commercial-off-the-shelf tools has focused on providing the control engineer with complex solutions for APC monitoring and maintenance. There are however many other stakeholders including operations, maintenance and management functions that must be made full partners in sustaining APC performance. To cater to the needs of these stakeholders, any solution must be easily accessible, provide clear monetized information and actionable guidance to allow them to realize the full potential of their APC applications.

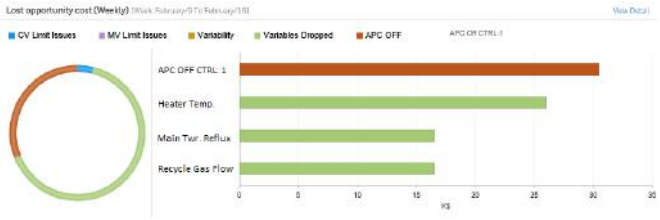
The key components required of any solution to meet the needs all stakeholders must provide:

- A cyber-secure means to uplift APC and process data from the process control network to an environment that is accessible to all relevant stakeholders within (and increasingly outside of) the organization. This can be done within the business network but is predominately being deployed to cloud environments.
- A means to historize large quantities of data to deliver long-term insights on APC performance. Without a long-term view of APC performance, it can be difficult to ensure that the full potential of the APC is maintained and a full appreciation of the value delivered by the APC is understood.
- Near real-time execution of APC digital twins, calculations and analytics without human interaction. The need for people to wrangle, cleanse or perform calculations on data creates a bottleneck that prohibits real time insights, while also impeding that person's ability to perform true value-adding tasks.
- Clear visualizations that enable all stakeholders to understand the current and potential issues that are leading to degraded APC performance. Many roles require an understanding of the issues causing APC performance degradation from a monetary perspective so that they can give it the appropriate level of attention. For example, knowing that an APC constraint is impacting charge heater firing is important, but knowing that it will cost the organization $125,000 per year by not doing anything about it provides the monetary context and visibility in the organization to make an informed decision.
- A concise set of actions to maximize APC performance benefits using evidence based insights. Many systems provide the capability to inform users of an issue, but they lack that ability to close the loop and provide a path to resolving those issues. By providing clear guidance on how to resolve issues identified and insights gained by APC digital twins, organizations can accelerate the time taken to minimize benefit degradation by incorporating these actions into daily work practices.



Long Term Performance

It is essential that the solution provides accurate information on incremental monetary value that each APC application has delivered to the organization. Without having a clear understanding of the financial benefit that an APC application is delivering to the organization, it is difficult to obtain appropriate buy-in from all stakeholders in an organization to ensure that benefits are sustained.

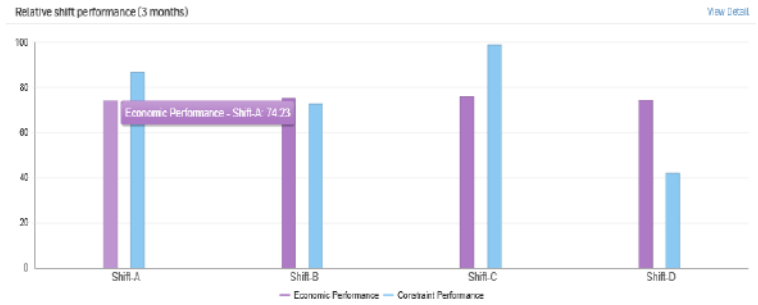


Lost Opportunity Cost

A solution must be able to illustrate to all stakeholders the potential benefit that could be obtained versus the current benefit being obtained. While it is important to be able to do this on a continuous basis and to be able to show the impact over daily, weekly and monthly period, what is more critical is the ability of the solution to identify the specific sources of lost opportunities.

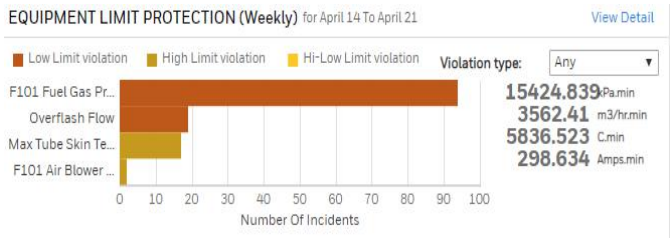
Relative Shift Performance

From a competency perspective, it is critical to be able to identify those who use APC application as per best practice along with those who could benefit from additional training to ensure they can balance process profitability against constraint performance. It is important when undertaking any form of shift performance analysis to ensure that it is done over a long period and considers other variables such as weather conditions, feedstocks and maintenance schedules.



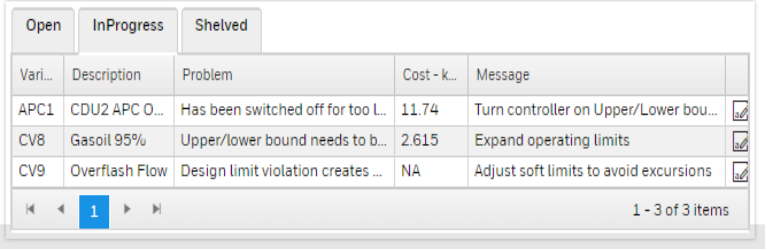
Constraint Violation Metrics

While operations typically have an awareness of the need to operate within equipment limits, they may not always understand why, or the financial impact that doing so can have. For this reason, being able to highlight the impact of equipment limit violations is essential in being able to enable all stakeholders to operate the process in an effective way. Additionally, this can provide critical information to maintenance departments who are often required to perform inspections based on equipment limit violations.



Actionable Insights

Central to the need for a performance management platform is the ability for clear, actionable guidance to be provided in a timely manner to relevant stakeholders. Doing so ensures that those responsible for any improvement actions can close the loop and maximize APC benefits. It is essential to ensure that any insights derived from such a platform are incorporated into a supporting business process that enforces a consistent decision making, prioritization and change management process.



REAPING THE BENEFITS

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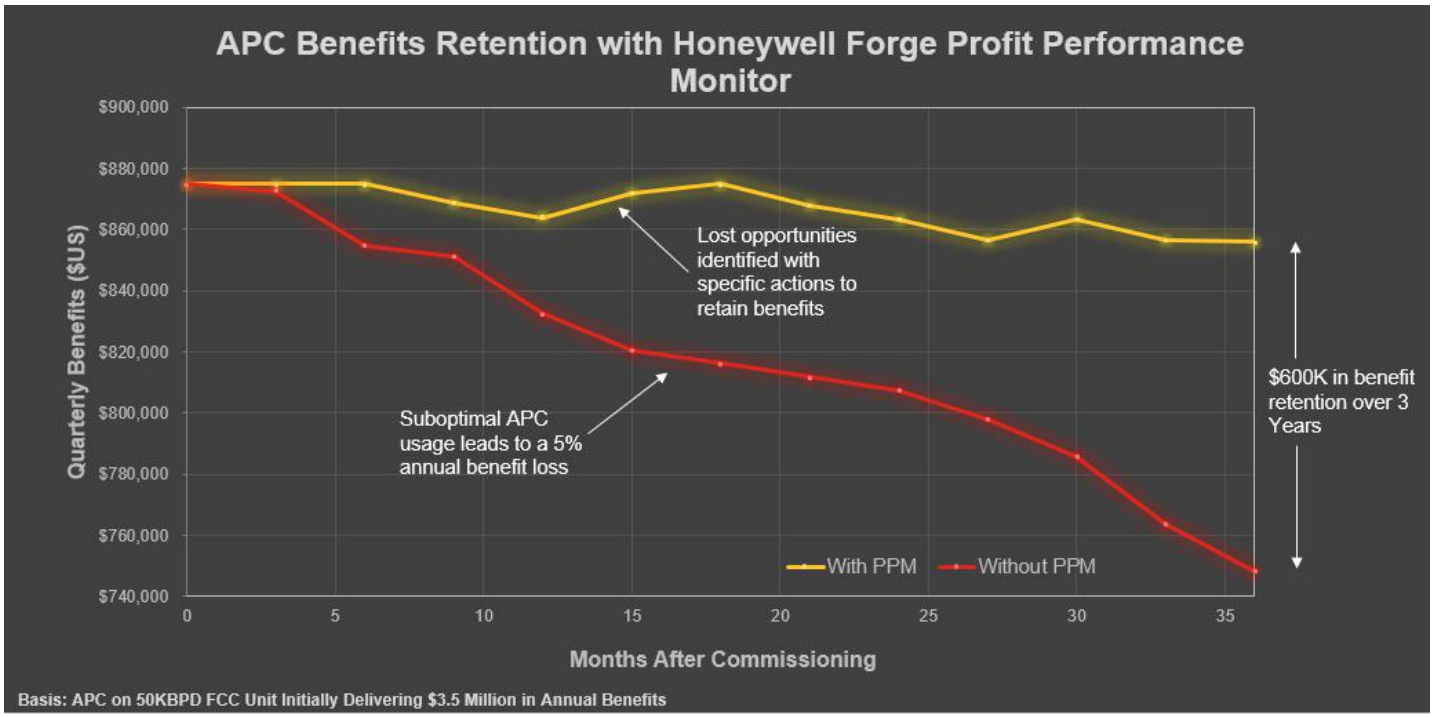
Honeywell Forge Profit Performance Monitor – an APC agnostic performance monitoring platform – retained more than $600,000 in benefits on a single APC application that would have been otherwise lost under normal site practices.

Honeywell Forge Process Performance Monitor – an APC agnostic performance monitoring platform – was deployed to monitor a single APC application that delivered $3.5 million in benefits per year when it was first commissioned. Over a 36-month period, the following was found:

- Sub-optimal APC usage lead to an average of 5% annual benefit loss. This benefit loss rate was less than half of the average APC benefit loss found in the market in in recent surveys.
- The accumulated benefit loss was almost evenly distributed between operational factors such as incorrect APC use, and external factors such as maintenance, feedstock and catalyst issues.
- The system successfully identified lost opportunities, along with specific actions required to retain benefits, and was adopted into standard operations and maintenance practices
- A total of $600,000 in benefits were retained that would have otherwise been lost under normal site operating practices



CONCLUSION

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To ensure that the significant monetary benefits that APC delivers are sustained on a daily basis, it is essential that digital twin technologies are augmented with a performance monitoring platform that enables all stakeholders of industrial process organizations to understand where opportunities to maintain benefits exist. Most importantly, clear guidance must be provided by the platform to enable teams to ensure they know how they can best act to seize those opportunities.

Building on decades of expertise in the delivery of over 3000 APC applications to more than 500 industrial sites worldwide, Honeywell's Advanced Process Control technologies have delivered over $5 billion of benefits to industrial customers since 1996. Advances in cloud computing and digital twin technologies have allowed Honeywell to deliver to the evolving needs of the process industry, specifically in this case of answering the question: How can APC benefits be maintained on a day-by-day basis in an effective manner?

To ensure that 30-50% of APC benefits are not lost within 5 years of deployment, and all benefits are not lost within 7, organizations should look to deploy APC performance monitoring solutions that:

- Are cyber-secure and accessible to all stakeholders - not just controls engineers.
- Retain enough history to ensure that learnings are not lost and long term benefits are understood
- Operate in near real time to ensure that opportunities can be acted on immediately
- Illustrate clear monetary opportunity values so that all stakeholders know what is at stake
- Provide prescriptive guidance on the actions required to close the loop and seize opportunities

The use of APC performance monitoring platforms such as Honeywell Forge Profit Performance Monitor are just one example of how industrial organizations can continue to work towards making every day their best day of production.

For More Information

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