GRIFFIN

AI Process Automation & Optimization for Power Generators

Tabe Of Contents

1. Introduction
2. Unique Power-Gen Challenges
3. Barriers to AI Implementation
4. Common Power-Gen Applications
5. Case Notes
6. The Griffin AI Toolkit

Introduction

Power generators across the globe are facing new and more complex challenges than ever before.

Mounting pressure for energy companies to reduce their emissions, minimize their carbon footprint, and increase demand reliability — as well as shifting business and consumer preferences — means that new, proactive solutions are needed now.

The sooner these solutions can be implemented, the better, as energy companies seek to compete with one another on a national (incredibly visible) scale and the U.S. energy industry as a whole seeks to strengthen its position against other countries' efforts.

One such solution that is not new to the industry but has yet to match the pace of others is artificial intelligence (AI). Historically, power generators have lagged behind other industries in the adoption of AI. A variety of implementation barriers are responsible for this.

Here, we'll explore these barriers and how the right AI solution can help power generators overcome them in a prioritized, proactive manner.

Unique Power-Gen Challenges

Every industry has its own difficulties with navigating change. But in power generation several financial, regulatory, and cultural challenges have combined to create a maelstrom of complexity.

Expedited Payback Periods to Offset Coal Plant Closures

Over the past year, a number of power generation companies have announced the planned closures of coal plants as newer energy solutions like solar and wind grow in popularity and competition. Fossil fuel-burning plants typically pay back the costs to build them over several decades. With plant closures often being expedited, companies are rushing to identify and implement alternative solutions for the communities they serve. While **recent analysis** showed that most plants would be paid off by 2035 (the date President Biden set for his goal of 100% clean electricity), it still falls on energy companies to both get the most out of their existing assets that aren't yet paid off and to help fund future solutions.

Environmental Compliance is Becoming More Stringent

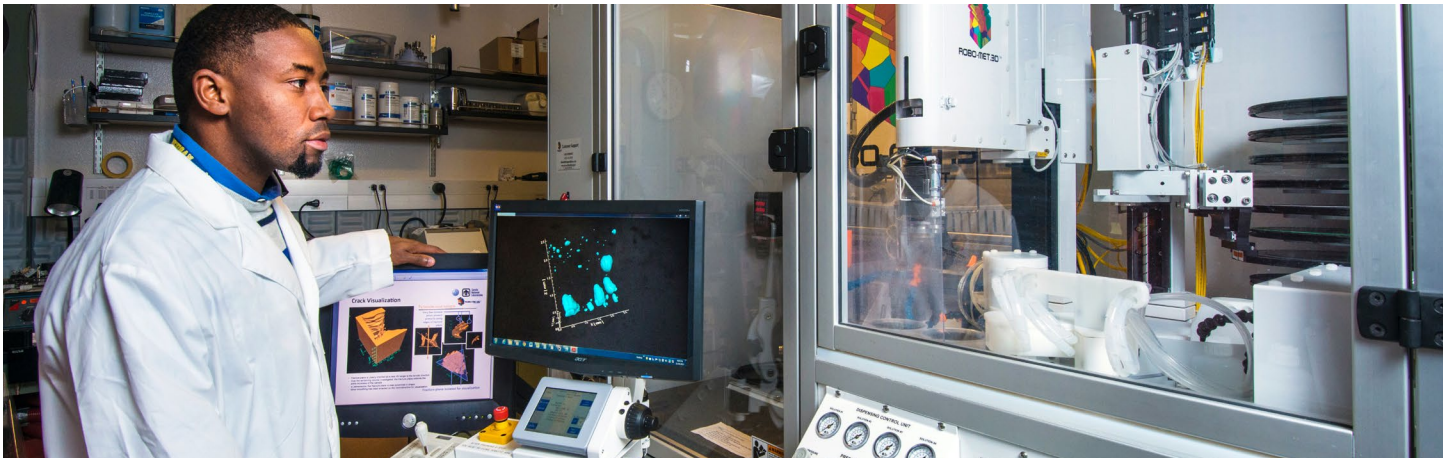
According to **a report** from Good Jobs First published in March 2021, the past two decades have seen states bring more than 50,000 enforcement actions against organizations that have violated clean air, clean water, and other environmental laws. Utilities and power generators ranked second on this list with more than $6 billion in penalties — only trailing oil and gas at $8.2 billion. With a new administration rapidly implementing policy to support new environmental goals, it's clear that power generators must accelerate their efforts to reduce their risk and improve compliance with environmental policy.

An Aging Workforce Puts Knowledge at Risk

A significant portion of the energy workforce is nearing retirement. According to S&P Global Platts, 30% of the workforce is above the age of 55. With so many workers about to exit, companies are facing significant tacit knowledge loss. While hiring more workers might seem to be the apparent solution, the industry is experiencing a lack of talent to draw from. The U.S. Energy & Employment Report found that 63% of utilities can't find talent due to insufficient qualifications, certifications, or education, with an additional 47% citing candidates' lack of experience, training, or technical skills.and gas at $8.2 billion. With a new administration rapidly implementing policy to support new environmental goals, it's clear that power generators must accelerate their efforts to reduce their risk and improve compliance with environmental policy.

Barriers to AI Implementation

Several industries are rapidly adopting AI solutions, while others — including the energy industry — are in need of the right tools to lower these barriers to an acceptable level.



Operations & Engineering Adoption

The Barrier:

While an entire organization will benefit from adopting AI solutions, the two roles that carry the most responsibility and daily interfacing with them are process operators and engineers. To ensure employees in these roles accept AI, companies must ensure that the effort and resources needed are minimal. Adding engineering time for support or disrupting current practices to implement AI will hurt adoption rates.

The Solution:

An AI platform with short implementation timeframes that support existing practices — not hinder them.

The Barrier:

Process operators and engineers may resist automated AI solutions that feature closed-loop supervisory control. This is understandable as the perception is that the control logic can't be easily modified, doesn't support existing processes, and ultimately puts those processes at risk.

The Solution:

AI with robust tools to automate known relationships with predictable results, advanced AI for optimization within a known constraint system to improve the process, and transparent logic that can be modified to ensure overall synergy.

Solution Flexibility

The Barrier:

As outlined above, the energy industry is facing a variety of challenges and shifts that require flexibility and adaptability. Unexpected events or disasters, new laws and industry regulations, and technology shifts mean energy companies must be ready to respond quickly to maintain power, avoid fines, and meet consumer expectations and demands.

The Solution:

AI that supports rapid reconfiguration, automatic changes, prioritization of systems based on the needs of the company at any specific point in time.

The Barrier:

In any energy-related environment, there are countless processes running on numerous DCS and PLC systems. The complexity of process management only increases when multiplied by a company's number of facilities and the fact that processes are often unique to equipment, energy demands, and other variables. The last thing operators and engineers want is to implement solutions for each individual process.

The Solution:

AI that operates at the plant supervisory level and leverages data from all underlying processes, DCS, and PLC systems — creating a single inclusive optimization station.

The Barrier:

In order to optimize existing control systems, it maybe necessary for operators and engineers to involve the vendor or manufacturer due to those systems being "black box," meaning the decision-making methods in that system can't be physically interpreted or correlated by people. Or they must go through specialized, costly, and time-consuming training, which takes these essential team members away from their important daily tasks and focuses.

The Solution:

AI that integrates with existing systems without requiring outside assistance due to its open architecture. A no-code interface also eliminates the need for specialized training in programming and/or coding.

Misconceptions & Biases

The Barrier:

Neural networks (N-Nets) aren't new to the energy industry and have been in use for decades. Those with experience in their implementation will know that such efforts were intensely complex, particularly pre-2000 when technology was not as efficient as it is today. While N-Nets are still an important part of AI, they can become overburdened and difficult to maintain when they're the only solution available, as problems become exponentially complex.

The Solution:

AI that can leverage existing N-Nets alongside other algorithms to better control, contain, and reduce the complexity of the N-Net for greater learning and performance.

Existing Systems Already Provide the Capabilities Needed

The Barrier:

Existing DCS, PLC, or SCADA systems are being built with AI included in their systems. This not only limits the capabilities of the engineers and operators interfacing with them on a daily basis but also limits visibility. As a result, any issues or optimization efforts must be navigated within the confines of the system vendor's AI, further restricting the opportunities available for improvement.

The Solution:

AI that operates faster, more intelligently, and at a higher level than even SCADA systems to enable the insight and decision-making power generators need to move their businesses forward.

AI is Already Implemented in a Particular System

The Barrier:

AI is not a newcomer to the energy industry. A variety of equipment types, software platforms, and more already exist for the systems that companies use every day. However, often these AI solutions are specific to systems further down in the Purdue Model. While learning results may trickle up to the supervisory or control levels, the benefits are often siloed — preventing broader optimization opportunities from being realized.

The Solution:

A control-level AI solution that can accept and learn from data provided by lower-level solutions, enabling even more intelligent modeling, testing, and optimization work.

Common Power-Gen Applications

Throughout power-gen facilities, a number of common applications exist where optimization can yield significant benefits. However, without an AI solution, achieving the level of optimization needed is almost impossible.

Combustion Optimization

The complex nature of combustion processes in energy facilities make these systems one of the most difficult to control. As a result, they're also one of the most difficult to optimize for greater performance, reduced maintenance and downtime, and environmental considerations. However, thanks to AI, energy companies can leverage data they already have on combustion systems (as well as capture more) and begin developing solutions to realize the desired results.

Performance Objectives:

- Emission Reduction
- Heat Rate Improvement
- Unplanned Outage Mitigation

Sootblowing Optimization

Sootblowing, particularly for coal-fired plants, is often a determining factor between high efficiency levels and a variety of negative issues that include decreased system performance, inconsistent soot management across multiple crews, excess operating times, and outages. Because the conditions that affect soot buildup are constantly in flux, systems that control sootblowing must be able to adapt in an agile manner to improve performance, extend equipment life cycles, mitigate safety risks, and conserve energy.

Performance Objectives:

- Consistent soot management across operating crews
- Reduced time focusing on sootblower
- Better heat transfer leads to heat rate improvement

Hg PAC Optimization

Mercury (Hg) emissions are a serious environmental threat. Power generators involved in the stationary combustion of coal are the second largest source of emissions in kilograms according to the Global Mercury Assessment from the U.N. These emissions are commonly countered through the use of powdered activated carbon (PAC). While PAC injection systems are common, they are also costly, can add work effort, and even be detrimental to other processes.
=However, the use of AI can help power generators better control Hg emission reduction processes and make progress toward environmental goals.

Performance Objectives:

- Minimize the amount of PAC used
- Reduce high opacity occurrences in plumes
- Maintain or reduce Hg emissions overall while lowering costs

Cooling Tower Optimization

Cooling towers are essential for power generators, but systems that use fans to create the draft needed use a substantial amount of power — leading to higher operating costs and potentially decreasing overall operating efficiency. Fortunately, systems that are equipped with variable frequency drives (VFDs) or multiple power output settings can leverage AI solutions to optimize that power consumption while maintaining or increasing process performance.
Even an ability to optimize which fans are turned on and off can lead to performance improvements.

Performance Objectives:

- Reduce power consumption
- Improve process performance

Case Notes

Rush Island

The Ameren Rush Island Energy Center is a coal-fired power station in Festus, Missouri. The utility engaged Taber International, LLC — an engineering services firm focused on serving electric utilities using AI to identify opportunities for efficiency and emission reduction.

The Problem

The Rush Island plant was looking to reduce its emissions while also implementing efficiencies as part of its continuous improvement strategy.

Proposed Solution

Taber International utilized the Griffin AI Toolkit to optimize combustion and develop intelligent sootblowing practices.

The Result

Leveraging the AI Toolkit, Taber International was able to assist the Rush Island plant in not only averaging 0.081 lb/MMBtu in NOx emissions for 2015 without SCR or SNCR, but also ultimately winning PRB Coal Users Group Plant of the Year award in 2016.

Western U.S. Coal Plant

The Problem

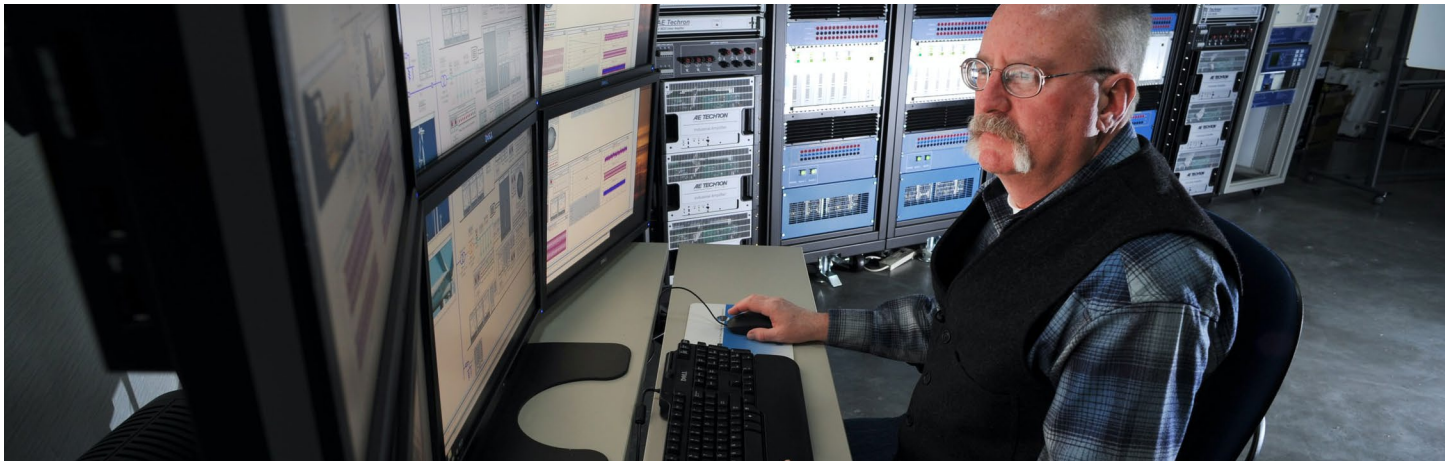
A Western U.S. coal plant had opacity issues due to ammonium bisulfate build-up in their ESP, which was due to the selective non-catalytic reduction system (SNCR) used to control nitrogen oxides (NOx) emissions. This led to significant regulatory derates during a period of high demand.

Proposed Solution

In partnership with Neundorfer, Griffin Open Systems set up an AI combustion optimization system using the Griffin AI Toolkit. Utilizing existing DCS, I/Os, and sensors, the Toolkit enabled the plant to bring emissions into regulatory limits and minimize the use of the SNCR to avoid additional ammonium bisulfate build-up.

The Result

Thanks to its rapid prototyping capability and ability to run multiple models in tandem, the AI Toolkit revealed that NOx emissions could be reduced so dramatically that the SNCR wouldn't need to operate to ensure compliance. Because of its rapid implementation as well as not having to invest in new hardware, the plant's savings from avoiding derates recouped the AI solution cost in only one year.



The Griffin AI Toolkit

Developed from the ground up by Griffin Open Systems, the AI Toolkit is a no-code solution that enables power generators and others to create new process models, perform optimizations, develop custom tuning screens, implement custom algorithms, and more in a single platform — enabling significant time savings while converting process analyses into action.

Adivarent Control

With the AI Toolkit as its foundation, Adivarent Control serves as an AI- and rules-based assistant for operators and engineers. Operating between control levels 2 and 3 in the Purdue Model, Adivarent Control enables efficient and responsive optimization to maximize system performance, automate lower-level functions, reduce alerts, and decrease administrative hassles. With Adivarent Control, power generators can model unique scenarios to determine potential outcomes as opposed to relying on a single model. By automating the mundane and optimizing the complex, Adivarent Control is the power generator's ideal solution for navigating the complexities facing the industry today. Learn more about Adivarent Control.

Open Architecture & DCS-Agnostic Capabilities

When you're seeking to optimize processes, black-box systems will only impede your progress while increasing your time and cost investments. The AI Toolkit eliminates these hassles thanks to its open architecture and DCS-agnostic integration capability. This built-in design flexibility means your team can put the system to work more rapidly — and pursue digital transformation sooner — without the need for support from equipment vendors.
The Toolkit integrates seamlessly into existing enterprise architecture, keeping your investment manageable while enabling you to benefit from optimization efforts.

Adivarent Control

With the AI Toolkit as its foundation, Adivarent Control serves as an AI- and rules-based assistant for operators and engineers. Operating between control levels 2 and 3 in the Purdue Model, Adivarent Control enables efficient and responsive optimization to maximize system performance, automate lower-level functions, reduce alerts, and decrease administrative hassles. With Adivarent Control, power generators can model unique scenarios to determine potential outcomes as opposed to relying on a single model. By automating the mundane and optimizing the complex, Adivarent Control is the power generator's ideal solution for navigating the complexities facing the industry today. Learn more about Adivarent Control.

Graphical Programming Interface

Thanks to its no-code graphical interface, the AI Toolkit requires no specialized training programs or programming skills on the part of your process operators and engineers. By lowering the barrier to implementing AI in process control, the AI Toolkit enables more rapid adoption of this essential technology into a market that has long struggled to find the right solution. Software training costs aren't necessary, and engineers and operators can immediately focus on knowledge transfer from human to machine, ensuring it's captured and preserved despite the industry's aging workforce.

Rapid Prototyping

Alongside capturing institutional knowledge, one of the most immediate and advantageous benefits of the AI Toolkit and Adivarent Control is the ability to rapidly prototype new models. Following implementation, operators and engineers will be able to seamlessly develop new process flows on-the-fly, test them to determine their viability. This is attainable through all of the above aspects of the Toolkit and Adivarent Control — a no-code interface, design flexibility that works with existing systems, and operator/engineer knowledge capture.

Try the AI Toolkit Today

Set up a demo to see how the AI Toolkit and Adivarent Control will transform your operations.

griffinopensystems.com/try-buy