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White Paper

OPTIMIZE DECARBONIZATION VIA AI-POWERED MAINTENANCE

VIA COGNITIVE MODELS THAT ANALYZE ALL RELEVANT DATA AND DETECT HIDDEN TRENDS AND PATTERNS, AI GIVES OIL AND GAS COMPANIES EXTRAORDINARY NEW POWER TO:

- Establish a quantified, detailed baseline of operational normality
- Detect, track, and in some cases even predict anomalous events that fall outside that baseline
- Leverage this new insight to create and implement predictive maintenance strategies that maximize asset performance and reliability while minimizing downtime
- Ensure the infrastructure is hitting business and technical targets without unnecessarily replacing assets that are still performing well
- Preclude (when possible) problematic events such as slow-downs, stoppages, and flaring, and reduce the frequency, duration, and business impact of the events that do occur
- Substantially reduce greenhouse gas emissions that arise from production downtime
- Help organizations analyze and quantify the success of their decarbonization strategies

A CHANGING WORLD MANDATES A NEW APPROACH FROM THE ENERGY SECTOR

No industry faces challenges greater than those in the oil and gas space. Looking beyond the strong possibility that the world may already have passed peak oil demand, there is also the looming, inescapable issue of anthropogenic climate change and all its related complexities.

Mounting concerns about the global consequences of an unchecked warming trend have led investors, the media, and the general public to demand an effective response from oil and gas companies worldwide. Consequently, business leaders in the energy sector are moving swiftly, and in a variety of ways, to decarbonize operations wherever possible.

Most have deployed some form of digitization and already leverage it heavily in creating and executing decarbonization strategies. These initiatives have generally been effective, yet there is also still considerable room for improvement. In particular, artificial intelligence (AI) solutions are not fully deployed and leveraged.

PREDICTIVE MAINTENANCE IS KEY TO DECARBONIZATION—IF IMPLEMENTED WELL

To understand how AI can deliver these impressive benefits, begin by considering the traditional methods used by the oil and gas industry to maintain the large number of assets utilized in the production infrastructure.

To keep operations running as continuously as possible, and thereby minimize the unwanted carbon emissions that arise from production downtime, organizations have generally relied on both preventative and predictive maintenance processes.

Of the two strategies, preventative maintenance is significantly less efficient and effective. Here, the idea is to replace assets on a conservative regular schedule designed to ensure (1) assets are always replaced before the end of their expected lifecycles and (2) assets always deliver the expected performance and reliability. This approach, while certainly superior to a purely reactive strategy of replacing failed assets, has the underlying problem that it relies on statistical assumptions rather than objective facts.

Specifically, the expected lifecycle of a given asset may not reflect its true lifecycle; in the real world, assets may turn out to perform for either longer or shorter periods of time than expected. Similarly, true asset performance—whether considered on a granular level or abstracted out to a larger context—is generally not either quantified or tracked as part of preventative maintenance processes.

In consequence, preventative maintenance can lead to unnecessarily high costs when assets are replaced that might not actually require replacement. An even more substantial problem emerges when an asset fails before the end of its expected lifecycle and forces a work stoppage, which in turn leads to excess carbon emissions and possible compromises in worker safety.

Broadly speaking, predictive maintenance is a superior approach because it relies on sensor data drawn from production assets, and thus provides specific insight into how well (or how poorly) those assets are actually performing in real-time. By analyzing this data, the organization can accurately determine which assets require some form of maintenance (via calibration, replacement, or other methods), and subsequently keep maintenance strategies closely aligned with the dynamic requirements of the total infrastructure. This, in turn, minimizes downtime and resulting emissions. For these reasons, predictive maintenance is both more effective and cost-efficient than preventative maintenance. In fact, according to a recent study that tracked annual costs, while preventative maintenance costs $17/horsepower per year, predictive maintenance costs only $9/horsepower per year—a cost reduction of almost half. Furthermore, the corresponding reduction in carbon emissions directly fulfills organizational mandates and helps to differentiate the organization from less efficient market competitors.

However, predictive maintenance is also often significantly harder to implement and optimize than many oil and gas organizations expect it to be. Unless properly implemented, in fact, predictive maintenance may never fully yield all the expected benefits and outcomes.

In large part, this is because of the total data volume involved. To understand why, simply multiply the average number of sensors per asset by the total number of sensorized assets across the entire production infrastructure, all of which are continuously streaming data in real-time. Add to this the complete body of historical data collected over previous years, data needed to detect and isolate previous performance issues the organization would like to forego in the future.

Given such a data tsunami, how best can the organization sift through it all, find and confidently establish hidden trends and patterns, and ultimately leverage these new insights to inform optimized predictive maintenance processes throughout the infrastructure?

AI-DRIVEN INSIGHTS EMPOWER ORGANIZATIONS TO CREATE AND IMPROVE PREDICTIVE MAINTENANCE PROCESSES

This is exactly the question AI is ideally positioned to answer. Unlike human analysts, the Avathon Industrial AI platform has no theoretical upper limit in its capacity to ingest and analyze data, and can scale as required to suit emerging workloads and changing business requirements.

Part of that scalability lies in Industrial AI's ability to learn over time from newly-ingested data, becoming increasingly accurate and effective in its analyses and predictions. This adaptive design doesn't require human administrators to revamp the model to account for changes in variables or conditions.

Instead, such changes are automatically incorporated into the model by the Industrial AI platform itself. Thanks to such sophisticated cognitive models, Industrial AI platform can sometimes even find insights in the data that the most seasoned human analysts miss entirely.

All of these benefits, in turn, collectively help the organization ensure that operational infrastructure is continually performing at or beyond target levels. In this way, Industrial AI platform can play a key role in helping oil and gas companies execute and enhance the larger decarbonization strategy required by global circumstances.

REDUCE PRODUCTION DOWNTIME AND FLARING TO DRIVE DOWN CARBON EMISSIONS

As just one example of how this process can play out, consider how Industrial AI platform can help organizations minimize flaring—the process of burning off unwanted gases such as methane, which transforms them into carbon dioxide and sends that carbon into the atmosphere.

Flaring is estimated to add some 145B cubic meters, or 270M tons, of carbon emissions to the atmosphere each year—somewhere between five and ten percent of all greenhouse gases generated worldwide. Flaring also occurs in proportion to operational inefficiency, that is, the more production downtime occurs, the more unwanted gases will emerge as a consequence, gases that must be burned off. By making production assets more reliable, and thus making the infrastructure more efficient and its operations more continuous, AI can substantially reduce the amount of flaring an oil and gas organization carries out every year—a tremendous improvement on the status quo.

Minimizing flaring was in fact a primary goal of a recent Avathon engagement on behalf of an oil and gas supermajor. This organization sought to improve the efficiency of offshore production to drive down operational downtime and related flaring, while also improving overall safety for engineers and fleet operators. Additional value was expected to emerge from pursuing, in a quantified manner that could be brought to the attention of the public, the organization's aggressive implementation of its decarbonization strategy.

The supermajor had already undergone a substantial digitization transformation, and, hence, had both widespread sensorization and cultural awareness that data-driven decisions yield the best long-term outcomes.

It had also made initial efforts to implement its own AI capabilities but had run into difficulties in this stage of the engagement. Specifically, its in-house cognitive models had shortfalls in data streaming, alerting, model retraining, and model management that made them unsuitable for the production environment.

For this reason, the organization turned to Avathon for assistance in driving a successful project completion and business outcome. In the initial stage of the project, the supermajor sought to evaluate Avathon's model-building capabilities and submitted a blind set of data drawn from the separator system at one of its leading platforms. This separator system had a track record of unexpected failures in multiple glycol systems and export compressors. Avathon leveraged two to three years of historical data for each subsystem, developing models that were able to correctly predict 75% of the historical failures with an average of nine days advance forewarning. This exceeded the supermajor's success criteria of 50% accuracy and five days advance warning, proving the viability of the modeling approach.

The next stage of the project focused on operationalizing the models at scale in a live production environment. This involved developing the data pipelines for both modeling and live execution, as well as leveraging new innovations in normal behavior modeling to generate alerts involving fewer false positives and more precision.

Subsequently, the approved model was integrated into the Industrial AI platform, which governs data ingestion, model building and execution, alerting strategy, SME input, and retraining. Industrial AI platform was then deployed onshore in the supermajor's remote control center and since then it has provided alerting, 10-minute diagnostics, and a significant increase in overall operational visibility.

For instance, Industrial AI platform generated an alert concerning a critical export compressor. This alert was triggered based on a rapidly elevating level of asset risk, but by examining the feature importance and tag correlation, production experts were able to isolate the problem to one of the temperature sensors and thus determine that the asset was not at immediate risk. At the next scheduled maintenance period, it was determined that the temperature sensor had come loose and was providing faulty values.

This was a substantially faster and less costly assessment process than would previously have been triggered (normally, maintenance would have taken up to two days while also generating substantial costs in lost production).

The supermajor was very satisfied with the results of this project (which is already considered the largest successful AI deployment in offshore oil and gas) and is expanding the project to additional assets.

CONCLUSION

As oil and gas organizations strive to decarbonize operations, and thus address both internal and external mandates pertaining to global climate change, one of the most effective available strategies lies in improving production uptime and asset efficiency. Predictive maintenance processes can lead to such improvements. However, because predictive maintenance also requires a tremendous amount of data, it can be difficult to implement successfully without AI, and AI projects, in turn, usually require both deep and broad expertise to ensure a successful outcome.

As a global leader in industry-specific AI with a long track record of complex engagements, Avathon can be the trusted partner these organizations need, and its Industrial AI platform, which can scale to match any data volume, can play a key role in achieving project success.

Thanks to advanced cognitive models that ingest and analyze all relevant data, then generate accurate, actionable insights, Industrial AI platform is exceptionally well-positioned to help oil and gas companies drive up asset reliability and performance and drive down production shortfalls such as slowdowns and stoppages. These outcomes help reduce both flaring and excess carbon emissions and thus empower the decarbonization strategies central to the organization's future success.

ABOUT AVATHON

Avathon, a leader in Industrial AI, extends the life of critical infrastructure while advancing the journey toward full autonomy. Avathon's Industrial AI platform empowers commercial and government customers with scalable, secure, and value-driven solutions that enhance efficiency and resilience across heavy industry.

Contact Avathon today at info@avathon.com