WHITE PAPER

Achieving operational efficiency in energy

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Executive summary:

Energy companies are under pressure to accelerate the transition to sustainable energy generation. Despite the challenges associated with growing demands from government mandates and the public, energy companies are finding success by adopting new ways of working collaboratively in digital environments. Common data platforms and operations visibility help companies become more profitable and advance the drive to net-zero emissions.

This white paper considers the importance of optimizing operational efficiency in the energy sector. It looks at how analyzing operations data, enabled in part by cloud technology, increases operational efficiency, resilience, and agility. The paper also examines the possibilities and benefits associated with deploying AI/ML with its predictive capabilities.

Across the world, governments and citizens alike are demanding energy companies invest in a net-zero future and hasten the transition to more sustainable and renewable energy sources. To remain competitive, the industry must manage this transition in a way that maximizes operational efficiency. As they reduce their environmental impact, energy companies must allow workers to create a culture of continuous improvement that optimizes operational efficiency and productivity while effectively meeting the needs of an energy-hungry world. Achieving operational excellence leads to more efficient resource consumption and decreases byproduct waste while increasing profit margins.

Cutting-edge digital solutions provide the energy industry an avenue to both overcome operational challenges and improve profitability at the same time. By digitalizing work, one can significantly improve collaboration and efficiency.

Because digital work allows operators to complete tasks from anywhere in the plant, at different sites, or at remote locations, fewer operators can accomplish more, improving overall efficiency and helping build resilience against workforce disruptions. Innovative digital tools enable proper data contextualization and visualization, which allows the energy sector to improve operational decision-making.

Industrial software combined with trustworthy real-time and historical operational data is paramount to operational excellence. However, a robust and cyber-secured data management system must be in place. This system must extract data from the control room and make it available to other applications, without compromising operation security.

When the industry first embraced big data, many companies worked to collect as much with data since information implies it is enriched as they could on every aspect of their business, including physical plant assets, worker effectiveness and efficiency, and enterprise operations.

Improve operational efficiency by maximizing situational awareness, building a data management infrastructure that serves as a operational system of record and contextualized data visualization that supports real-time decision making.

Given the necessity of specialization, disparate teams within a company compiled and analyzed their own data. Unfortunately, that data has grown at a nearly incomprehensible scale. Much of this data quickly became inaccessible to stakeholders across an enterprise because it was locked up in isolated databases or data silos.

According to IDC research, 51% of organizations have difficulties accessing and integrating actionable, useful data.

Three keys for operational efficiency

The role and importance of digital technologies in achieving operational excellence is gaining more traction in the energy industry. However, to bring about effective and tangible change, these technologies must achieve the following:

1. Maximize situational awareness

Aging assets, tight profit margins, and increasing regulations especially around safety create the need to gain full visibility across operations relevant to the user's role, beyond the immediate situation or physical location. This comprehensive knowledge and insight allow operators to make decisions that drive efficiency, agility, and sustainability. No matter the age of the plant or the process, manual tasks must be automated to minimize human errors, free operators to concentrate on activities that prevent failures or process upsets, increase collaboration, and guide corrective actions.

The plant's operation control and human machine interface (HMI) software must support the operations management strategy, from IIoT architectures and remote edge management to multi-site control. The operation software must also allow easy interaction with third-party applications to facilitate data accessibility, enhance enterprise-wide collaboration, seamlessly unify operations, and open new pathways for information flow. Plants can go beyond situational awareness by creating a mobile-enabled visualization system that can inform decision-making by providing universal visibility tailored to a user's specific role.

Asset health and performance is a key ingredient to situational awareness because it improves reliability and identifies areas for proactive maintenance. Advances in AI/ML technology enables operators to use risk-based guidance to improve asset strategy, asset analytics, and maintenance execution.

The use of distributed energy resources adds complexity to the operations and controls of the electric grid, from generation all the way through the end-user.

Situational awareness for a large power utility means knowing the health of its assets and impact on reliability. For a wind farm, situational awareness is better predicting wind speed and its impact on power generation. For a power utility owning generating assets in different countries or dispersed geographically area, situational awareness means monitoring power generation in real time from a centralized location.

2. Data management infrastructure is central to any long-term strategy

The adoption of digital tools has markedly increased the volume and complexity of the industrial operations data landscape. As the energy sector continues to innovate and involves more stakeholders, data integrity and security will continue to play an important role. Optimizing operation efficiency and productivity rely on visibility at all points across the value chain. Decisions made by one stakeholder could depend on decisions made by other stakeholders. These decisions need to be made in real-time but must be based on data shared across the ecosystem.

This data exchange relies on the retrieval of operational data from the control room and other sources, without jeopardizing data integrity or operational safety. A data management system must ensure the proper archiving, organization, and accessibility of operational data. This data must be easily available to a broader set of data consumers and decision-makers, in real-time, and structured in a way that amplifies its value. An operations data management infrastructure must present persona-based, contextualized views of data and information, making it a single source of truth for self-service insights, visualizations, and analyses.

Allowing unstructured operational data to build up in data lakes and catchall repositories is a dangerous approach. Traditional IT technologies tasked with utilizing raw data devoid of structure and context can create more problems than they solve. This means businesses must spend more time wrangling data than using it to deliver business value and meet ESG mandates.

Sharing data also improves the transfer of institutional knowledge and prevents workforce burnout. Even when workers are away from the plant or retire, storing information in a central digital repository rather than in disparate systems, or even on paper, retains their knowledge for a new generation of workers.

Empowering workers with digital tools also improves productivity. By applying analytics to data, you can give newer employees the ability to find all the relevant and required information for a given asset. Analytics can alert them about abnormal conditions that, in the past, they might have needed to rely on more experienced workers to recognize. Furthermore, applications using advances in AI/ML also augment the capturing and transferring of knowledge from subject matter experts in the organization.

Harnessing data

The amount of data that is available to power plant operators as well as fleet and grid managers is growing exponentially. In ERCOT alone, more than 570 generators report their status every 2 seconds, synchrophasors report voltage and current information up to 60 times a second, and roughly 10 million smart meters report consumption data four times an hour.

Meeting the challenge to maintain availability and reliability, while integrating increasing amounts of renewable energy, requires treating data as a critical asset. The importance of data is changing the role of IT departments within utilities. Now they are responsible for turning data into a reliable and available enterprise asset that can inform decision-making for effective integration of renewable power.

A typical wind turbine can generate an average of 350 data streams, sampled every 60 seconds. This represents 504,000 samples per day per wind turbine. Note: As of January 2022, there were over **70,800** turbines installed in the US.

The added volume and disparity of operational data necessitates that the data infrastructure management organization fits the following criteria:

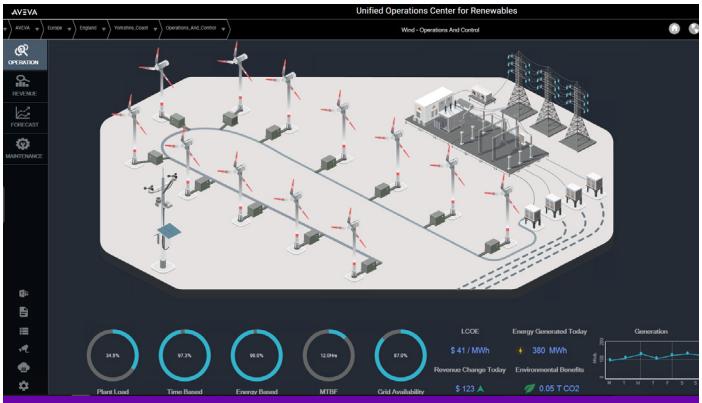
- Seamlessly interface with numerous control systems, such as SCADA, energy management systems, and others.
- Ability to aggregate, organize, standardize, and contextualize raw data from any source.
- Self-serve digital tools with streaming analytics, events, and notifications
- Rapid data processing and advanced data visualization capabilities to allow near-instantaneous situational awareness in an OT network or other environment.
- Enables data-sharing across the entire enterprise, from operations to business.
- Create a “passive copy” of critical, real-time operational data for personnel to peer into control room data without interfering with the actual controls.

3. Contextualized data with centralized visualization

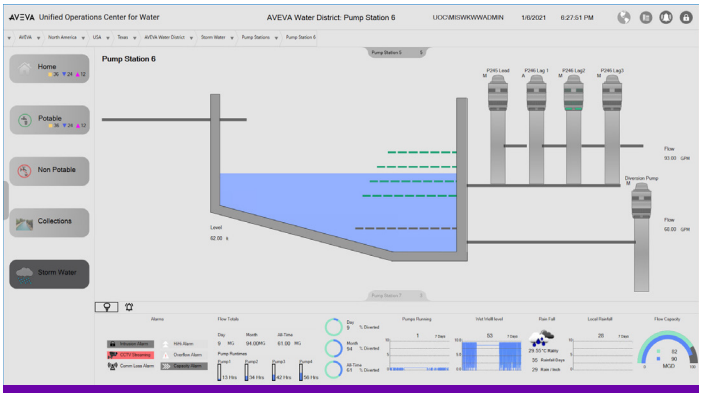
One of the primary uncertainties facing energy sector organizations is responding effectively in real-time to information about problems, as well as identifying complex patterns from data and relating them to business goals to improve the efficiency and productivity of operations. Contextualization is the key to actionable information.

Uncover previously inaccessible value by converging engineering, operations, and business data in context. Give teams self-service access to context-driven data for faster insight. When information is shared via centralized visualization, operators can collaborate on the same information at the same time. A real-time digital thread can increase asset utilization and situational awareness and improve the reliability of operations. As a result, plants can achieve the agility and resilience they need to stay competitive.

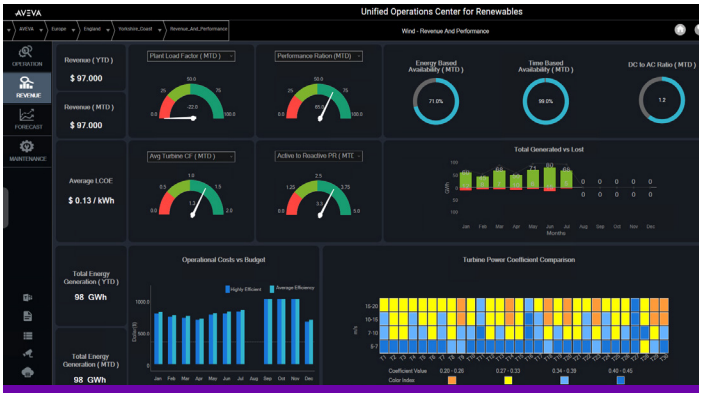
KPI dashboards



Operations overview



Drill-down metrics



Notifications and trends

Contextualized data and universal visualization are important. They become critical when operations are large and complex, such as in the oil and gas (O&G) industry. As markets become increasingly volatile and margins become slimmer, O&G operators are turning their attention inwards to find ways to unlock value and better decision-making across operations and the entire value chain – from the individual asset and plant level to the control room to commercial and other stakeholders. Gathering data alone is not sufficient: **IBM** estimates that the average offshore production platform has over 80,000 data streams from IoT sensors and generates petabytes of data. However, most companies are struggling to translate this into better decision-making and delivering value. A recent BCG study shows that less than **15%** of O&G executives believe that the data collected from operations was delivering the value creation that was initially expected.

O&G companies that derive the most benefit from data use are ones that can centralize all this data into an easy-to-consume, holistic, scalable visualization that enables everyone to make more informed decisions. They integrate data streams from across operations and the asset lifecycle – from engineering data, real-time operations data, maintenance data, financial data, and even external data sourced from third parties (such as weather and GIS data). Once this end-to-end visualization is provided for operators in an open and secure solution, it can enable huge improvements in decision-making and drive operational efficiencies to the tune of tens of millions of dollars per year. As an example, a field worker using a combination of real-time operational data can reference engineering and maintenance data to get ahead of a failing asset and fix the problem. With the same visibility, management stakeholders can also support or send additional resources, if needed. However, if significant data silos and visibility challenges remain, this problem won't be easily solved. The International Society of Automation **estimates** that O&G producers suffer from 32 hours of downtime per month on average, with a cost of $220,000 per hour, amounting to $84 million annually per facility. Effective end-to-end visibility can help mitigate this scenario and result in serious OPEX savings.

Taking the next step in your efficiency journey

The energy sector plays a significant role in the move to decarbonization to meet the target for half of all power to come from renewables by 2035. Digital transformation can support this decarbonization effort now, notably with several performance optimization quick wins that also build momentum and lay a solid foundation for the future.

Organizations that are focusing on their teams' situational awareness, centralized data management, and visualization are empowered to do more to support their drive for operational efficiency. This opens the door to new opportunities to do more with the data and visibility they have. When data is made available throughout the organization users can make the right decisions quicker and support both agility and efficiency and, ultimately, organizational innovation.

The data from operations as well as the broader organization becomes foundational for decision-making. This includes bringing together the right platforms for data and visualization including operations, CMMS, financial, IT, engineering, asset performance, and other business data. Starting with these building bricks supports organizations that look to take the next step in their operational maturity and leverage this wealth of information to apply analytics across their data to reveal further efficiency and value leaks.

The responsibility of operational excellence doesn't fall solely on the operations teams; it should be part of the very fabric of the entire organization. By empowering employees with self-service access to contextualized operations data, companies can foster a data-driven culture that relies on quality, validated, trusted, and governed operations data. This access allows every stakeholder to understand individual, division, and company-level performance and KPIs. As with any KPIs, what gets measured gets managed, and increased visibility and accountability enables users to make real and continuous changes that affect the bottom line.

Maturing your decision-making with analytics

Optimizing the performance of existing assets improves both their reliability and maintenance requirements, saving time, money, and resources. It also improves efficiency and output while reducing waste. The data that an organization has available in the right context can also help with the types of analysis that can be done. With the right set of data and visibility organizations can apply analytics from the more foundational performance monitoring towards predictive analytics where highly process-intensive industries can unlock significant value while reducing downtime.

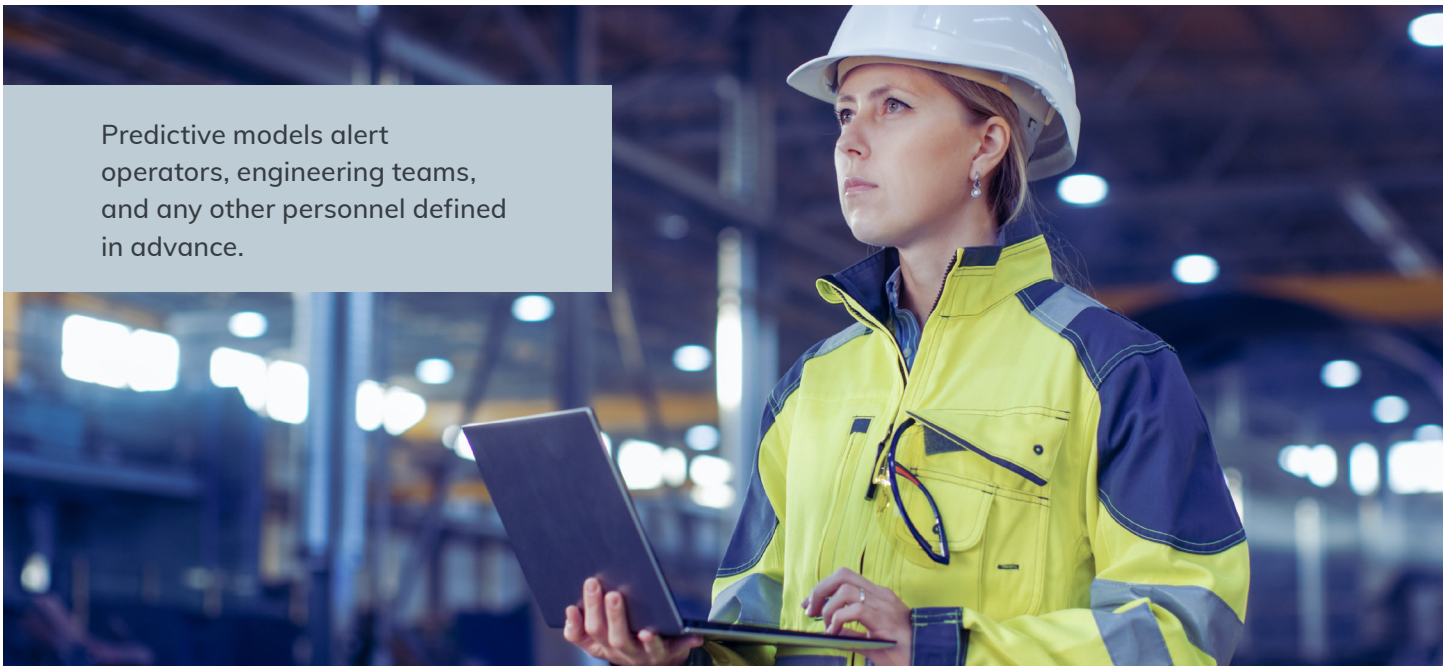
Leveraging data and visibility to make the move into advanced analytics

Aging, unreliable assets often do not provide adequate visibility into maintenance conditions. Not only do calendar-based maintenance procedures create operational inefficiencies, as assets might be taken offline unnecessarily, but they also cannot prevent asset failures and accidents. Preventive maintenance assumes a failure pattern that increases with age or use. According to **ARC Advisory,** unfortunately, failure due to age applies to only 18% of assets. Eighty-two percent of assets display a random failure pattern. By moving to proactive maintenance techniques like condition-based, predictive, and prescriptive maintenance, plants can limit workers' exposure to hazardous environments without incurring unplanned downtime.

Forward-looking power generators have the vision to provide low-cost power in a safe, clean, reliable, and sustainable manner for customers. These companies are constantly pursuing innovations to boost efficiency and sustainability throughout their operations. The industry leaders continue to move from reactive to AI-infused predictive and prescriptive operating and maintenance models to improve plant availability, increase reliability, and enhance safety performance. Bringing this level of analytics together as part of their overall enterprise visualization will continue to advance their digital transformation journey.

Taking a hybrid-cloud approach

Energy companies are also poised to benefit from new and improved cloud-based services. These services enable data sharing in a way that protects underlying physical control systems and the IT infrastructure from external access. This opens the door for seamless data sharing in near real-time with regulators and other trusted ecosystem partners such as vendors, partners, or digital service providers. Cloud-based data sharing can eliminate precarious alternatives that are either expensive to set up, difficult to manage, or create unnecessary cybersecurity risks. These risks include giving external partners access to the company's virtual private network (VPN), sending large spreadsheets via email, or even letting users periodically come on-site to retrieve data.



Conclusion

According to McKinsey & Company's **Global Energy Perspective 2022 report**, investments in energy supply and production are expected to double by 2035 – and nearly all growth is expected to come from new decarbonization technologies.

However, to ensure their investments are successful, energy producers must lay the digital groundwork that transforms the way their teams work and sparks industrial ingenuity. Through the digital initiatives enabled by the latest technology, companies in the energy sector can build an industrial information infrastructure that allows them to visualize and share this information, fostering collaboration both within their teams and with their partners, and achieve operational excellence.

About the authors

Rishabh Singhal works as the Industry Marketing Manager for Oil, Gas and Energy segment at AVEVA. A technologist at heart, he is passionate about the ongoing digitalization of the energy industry and has worked with operators, EPCs, OEMs, and consultancies to drive operational efficiencies across the value chain. He also has a deep understanding of energy market dynamics and is passionate about the economics of the energy transition.

Douglas Nunez is the Power Industry Global Marketing Manager at AVEVA. With over 20 years in the Power and Utility area, Douglas has a deep understanding of power market dynamics, including key issues, policies, and trends affecting renewable energy development.

Jonathan Pegg is a Product Marketing Manager at AVEVA. He is interested in how technology and innovation power digital transformation in the industrial space. Jonathan has almost 5 years' experience working with AVEVA PI System in technical product support, product launch and in his current role. He has a background in physical chemistry and possess a doctorate (PhD) from the University of Bristol, UK.

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