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Advancing the field: Best practices for national oil companies to meet emissions goals

Authored by:

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Cindy Crow,
Industry Principal, Oil and Gas, AVEVA

When it comes to meeting aggressive net-zero emissions targets, oil and gas companies must undertake two major tasks: They must both capture hard data to document actual emissions and use that data to make informed decisions. Based on the extensive prior experiences of international oil and gas companies and NOCs, below are some best practices and technologies national oil companies (NOCs) can adopt to reach their emissions goals.

Assessing the status quo

Against the backdrop of the post-pandemic economic recovery, oil and gas prices are rising. NOCs control approximately two-thirds of global crude oil reserves. More than half of global gas producers are competing with other energy providers to optimize production, despite having had their capital slashed during the pandemic. Given market instabilities and increasing environmental regulation, NOCs must be poised to strike a balance between increased production and reduced emissions in the most practical, profitable, and environmentally responsible way; short-term gains cannot be embraced at the risk of ignoring growing pressure to reduce emissions. To embrace environmental and economical accountability, NOCs must reduce the upstream production emissions that continue to plague so many producers.

Fortunately, NOCs have ample opportunities to learn from other oil companies and their data-management advisors. More than ever, fuel producers are relying on advanced digital tools, from better sensors to field-data capture solutions to multi-layered data management and analytics. Their experiences **converting raw data into value-added intelligence** offer tremendous insight into the future of sustainable, efficient growth.

According to the Boston Consulting Group, "85% of organizations (across nine major industries) are concerned about reducing their emissions, but only 9% are able to measure their emissions comprehensively," including Scope 1, Scope 2, and Scope 3 emissions from upstream and downstream activities. Furthermore, "only 11% have reduced their emissions (by at least 75%) in line with their ambitions over the past five years."

Adopting best practices for emission reduction

Dealing with hundreds of upstream wells spread across the landscape – each with its own variable levels of daily batch-like output – is significantly different than measuring emissions from the single continuous-process refinery the wells feed. Whichever emission-reduction technologies they eventually employ, NOCs should establish reliable benchmarks for their current emissions from well-drilling, well-production, gathering lines and stations, gas processing plants, and support activities. Likewise, NOCs should collect information on volatile organic compounds (VOCs) and primary organic contaminants (POCs) that might be venting from condensate oil tanks, separated-water tanks, and various points along the lines from well-head separator to gas-distribution pipeline.

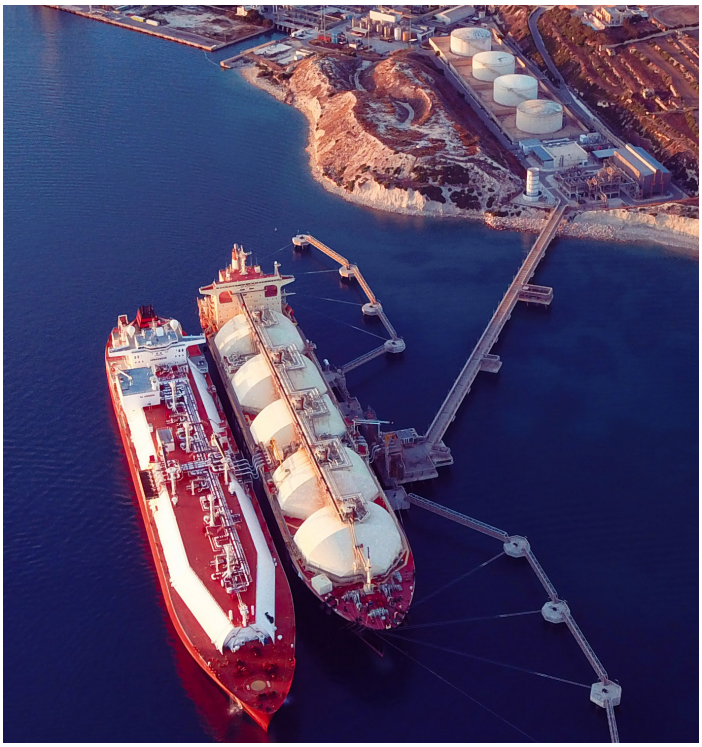
NOCs serious about improving emissions control should consider the following best-practice guidelines leading global oil and gas companies are implementing:

- **Build a data-centric operational perspective.** Adding a layer of emissions-related data to existing operational data management practices provides an efficient, cost-effective route to meeting emissions goals. Fortunately, real-time operational management **platforms** can be expanded to capture small, hard-to-measure details, provide better analytical insights for emissions-related performance, and centralize information.

  With so many potential factors to monitor, accounting for each one requires robust and versatile **data collection, data management, and data analytics capabilities** that enable decision-makers to understand the big picture in one comprehensive platform. Centralized data collection and management helps to keep data contextualized, permits users to build their own asset frameworks, provides comprehensive visualization tools, and enables decision-makers to connect their enterprise systems to a strong, scalable, and flexible analytics engine.

  Be sure to document and validate each step of the way to build trust, garner management buy-in, and get co-workers to appreciate the value the new practices add. Train employees to understand how real-time data solutions are structured, so they gain confidence in the approach. Training employees using concrete, real-world contexts and familiar, accessible terminology helps users transition to new practices.

- **Establish net-zero emissions baselines at the source.** With multiple, readily available opportunities to reduce emissions throughout upstream production, establishing an accurate baseline for future comparison is a vital first step. It's important to quantify emission reduction from every potential source and process, including low-emission production techniques, vapor recovery units, reduction of natural-gas flaring, and reduction of methane leaks in oil and gas production tank batteries, among others. Other production-related strategies – improving energy efficiency, using renewable-energy sources, carbon capture, optimizing driving routes from well to well for operations and maintenance-personnel, and more – also offer opportunities to decrease net emissions.



- **Employ the best technology and tools.** Good strategies for emissions reduction and carbon-capture-utilization-and-storage (CCUS) technologies can include electrochemically modulated carbon capture and high-temperature metal oxide adsorbents, electrochemical and thermochemical CO_2 fixation, re-injecting carbon-laden water at working wells, CO_2 sequestration in geologic reservoirs, vapor control systems on tanks, and catalytic converters on gas turbines and internal combustion engines used at production facilities and along pipelines.

  It's also critical that NOCs monitor any greenhouse gasses that might still escape. Often, the most successful aerial emissions monitoring strategies use a combination of tools. Technologies like drones, planes, helicopters, or low-level satellites equipped with infrared-photography or spectrometry can complement a host of well-mounted and ground-based remote sensors.

  Never underestimate **the importance of a good data analytics platform** to access, integrate, analyze, and layer historical and real-time data from all emissions measurement resources under a single pane of glass. Because **data context is extremely important,** be sure to include capabililities that support the rich data needed to achieve higher level analytics.

- **Prioritize easy-to-implement measures.** Even modest initial efforts to understand and optimize environmental performance are important first steps toward net-zero emissions that won't compromise productivity or profitability. The insights NOCs gain from better analysis of their existing data can guide the earliest, easiest, and most economical steps toward long-term improvements. But be sure to address currently overlooked or underappreciated factors as well, including both the data capture and data analysis technologies involved.
- **Be transparent.** Public awareness, heightened by increasing news coverage of extreme weather events and the recent COP26 climate summit, is raising expectations of progress. Having data resources to document tangible progress toward goals provides advantages both in terms of public opinion and competition in the global marketplace. For example, net-zero initiatives may soon drive a need for natural gas source tracing, meaning that natural gas prices can vary based on the sustainability of the source.

Support better logistics

Improved data-management practices that support new physical interventions can go a long way toward lowering emissions impacts, even as efforts to capitalize on current demand create added pressures on long-term net-zero emissions goals.

- **Reduce emissions.** Look first at above-ground practices, such as the venting of naturally occurring CO_2 or flaring of methane, which are a large part of unwanted emissions yet offer some of the most affordable opportunities for reduction. While measuring the emissions from a flare caused by a system upset may be straightforward, analyzing the conditions that caused the upset often proves more complicated. Gaining an understanding of a particular problem's root-cause is the first step toward preventing reoccurrences.

  Wells are only one source of emissions. In aggregate, vehicle emissions that are produced when personnel visit wells in the field can likewise account for a good deal of emissions. By using a robust operational data system, NOCs can reduce the overall number of hours driven, thereby cutting vehicle emissions significantly. Likewise, the right digital solution can help optimize logistics, such as sending the right people with the right skills to repair and maintain wells at the right time. Calculating opportunities for using renewable electricity sources and low-carbon hydrogen in upstream operations can also reduce the total carbon footprint of the process.

- **Leverage stranded data.** Many data points with the potential to reduce emissions are not captured or, if they are, the data lacks the context and structure to be truly useful. A good data platform should make it easy to factor real-time data into a comprehensive sustainability strategy, which goes a long way toward improving operational insights and eventually achieving emissions goals.

- **Seek better data compatibility.** Without a fully integrated operational control system, users find that various data resources can be incompatible. An operational data platform that can extract data from disparate sources, contextualize it, analyze it, and visualize it in one custom dashboard will provide a better overview of individual processes and overall operations.

- **Ensure better data utilization.** One of the best ways to capitalize on every emissions-reduction opportunity is to maximize the use of data. Ultimately better documentation and more efficient operations can have a large impact in reducing emissions. To be truly useful, however, historic and real-time data must be accessible. Data siloes and standalone spreadsheets often create additional problems. It's likewise important to explore cause-and-effect relationships relevant to lower emissions and cost-saving options.

- **Overcome SCADA and DCS limitations.** Traditional control systems can be limited in terms of the layered inputs and higher analytical capabilities required to optimize emissions performance. Fortunately, they are easily complemented by data management platforms that extract operational data from multiple sources and leverage it to give users a better understanding of emissions data and emissions control.

Capitalize on better data analysis – Leaders to follow

Upstream oil and gas operations that have not yet moved beyond plant operating systems into analytical systems may experience confusion about data historians, data infrastructures, or operational data contextualization in a cloud platform. Fortunately, more than 80% of the world's top upstream oil and gas companies are already using an appropriate platform for real-time production insights, advanced equipment monitoring, and **oil and gas field analytics**.

- **Dolphin Energy** developed an Air Emissions Calculation System (AECS) for real-time emissions monitoring systems and fuel gas flow meters to meet environmental, regulatory, and corporate sustainability reporting requirements.
- Part of Shell's journey to advanced analytics included a CCUS application that needed to account for weather conditions in its assessment of real-time emissions levels at the surface of a site where CO_2 is injected into a depleted well (described at the 18:35 mark of this **video**).
- Sinopec bridged separate SCADA systems and used real-time data to monitor a pilot project for **secondary oil injection**, which led the organization to evaluate the same system for enterprise-wide analytics capabilities.
- Petronas displays real-time and low-frequency data for field, platform, well, and facility surveillance and optimization, which provides **automated analytics and workflows** to help their operations carry out condition-based maintenance tasks as quickly and efficiently as possible.

About the author

Cindy Crow is an Oil and Gas Industry Principal for AVEVA. She is a 39-year Oil and Gas industry veteran, her career has included Chevron, Mobil, Baker-Petrolite, Nalco, and Schlumberger prior to joining OSIsoft/AVEVA. She is experienced in assessing current use of engineering, information and automation technologies, developing strategies and plans to drive business value. She holds a BS in Chemical Engineering and an MBA in Marketing and International Business.