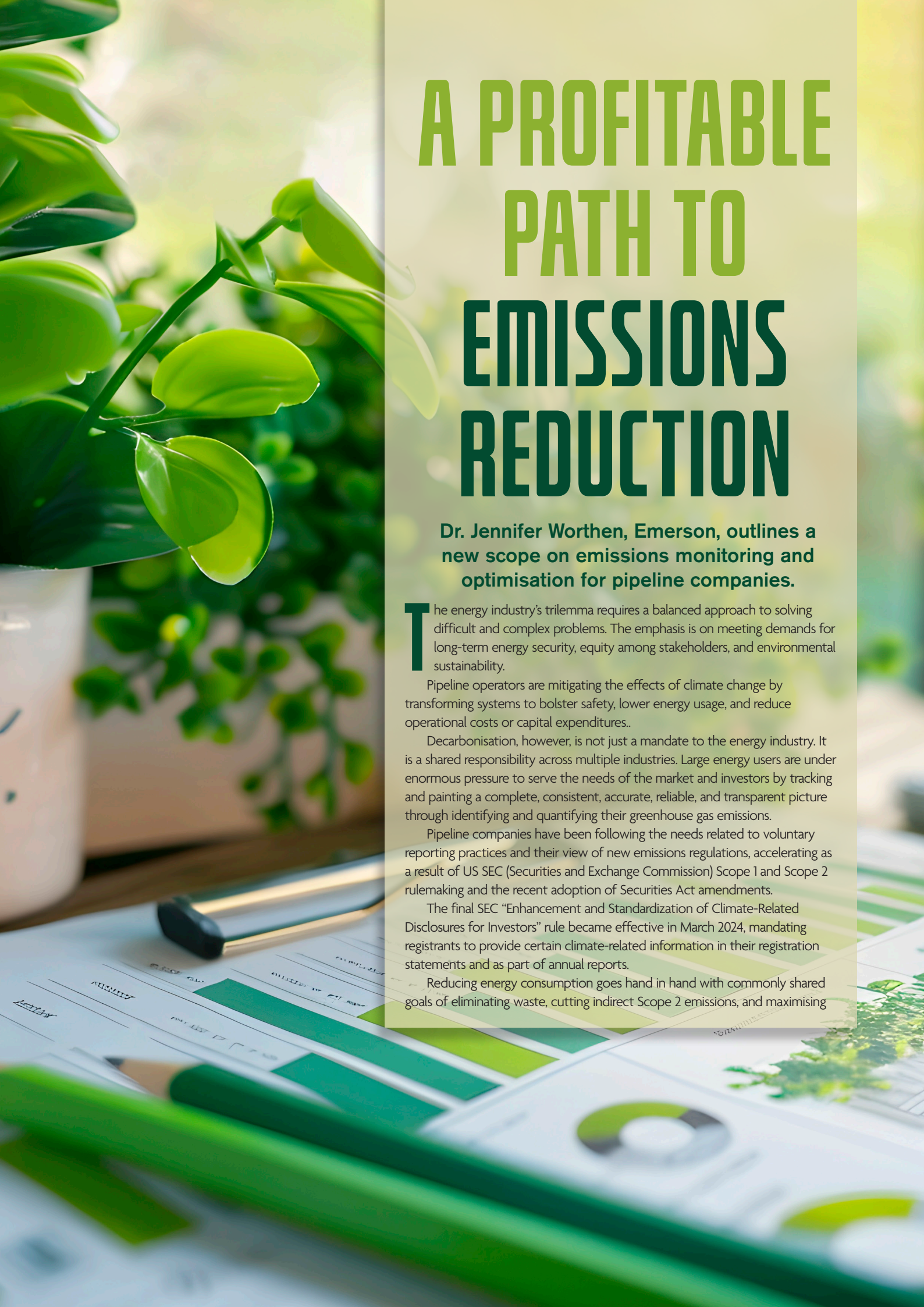

A PROFITABLE PATH TO EMISSIONS REDUCTION

Dr. Jennifer Worthen, Emerson, outlines a new scope on emissions monitoring and optimisation for pipeline companies.

The energy industry's trilemma requires a balanced approach to solving difficult and complex problems. The emphasis is on meeting demands for long-term energy security, equity among stakeholders, and environmental sustainability.

Pipeline operators are mitigating the effects of climate change by transforming systems to bolster safety, lower energy usage, and reduce operational costs or capital expenditures..

Decarbonisation, however, is not just a mandate to the energy industry. It is a shared responsibility across multiple industries. Large energy users are under enormous pressure to serve the needs of the market and investors by tracking and painting a complete, consistent, accurate, reliable, and transparent picture through identifying and quantifying their greenhouse gas emissions.

Pipeline companies have been following the needs related to voluntary reporting practices and their view of new emissions regulations, accelerating as a result of US SEC (Securities and Exchange Commission) Scope 1 and Scope 2 rulemaking and the recent adoption of Securities Act amendments.

The final SEC "Enhancement and Standardization of Climate-Related Disclosures for Investors" rule became effective in March 2024, mandating registrants to provide certain climate-related information in their registration statements and as part of annual reports.

Reducing energy consumption goes hand in hand with commonly shared goals of eliminating waste, cutting indirect Scope 2 emissions, and maximising

profitability. A trend has additionally been identified toward differentiating minimising cost (using a cost-based objective function) and minimising Scope 2 emissions (using an emissions-based objective function).

Energy security is commonly defined in the context of a nation's ability to satisfy contemporary energy demands, and maintain the resilience, safety and performance of its energy infrastructure. The tightening of regulatory environments isn't limited only to what's happening in the US and Europe. Additional and more comprehensive policy reforms are already being anticipated.

An energy system can align on environmental quality and comply with the regulations, ensuring Scope 2 emissions monitoring and reporting requirements can be met while being proactive about retaining organisational preferences for adaptation.

A practical approach when considering the use of emissions regulations, monitoring, and/or reporting software is to look through each of these lenses, considering the potential of simultaneously accessing and taking advantage of more than one option.

Updated viewpoint on emissions

Electricity is a primary power source for the pumps used to propel products such as crude oil and LNG through pipelines and storage facilities. The pipe, pumps, and valves of a liquids pipeline themselves are not a primary Scope 2 factor as they emit hardly any fugitive or vented emissions.

Inventory guidance for the Scope 2 initiative is specifically set forth to standardise how corporations measure emissions from purchased or acquired electricity, steam, heat, and cooling. It covers indirect emissions from generation only, i.e. emissions physically occurring at the facility where energy is generated.

This accounts for emissions from generating energy that is purchased or otherwise brought into the organisational boundary, including from sources that the reporting company owns or controls, and emissions resulting from the generation of electricity the company purchases from a utility provider.

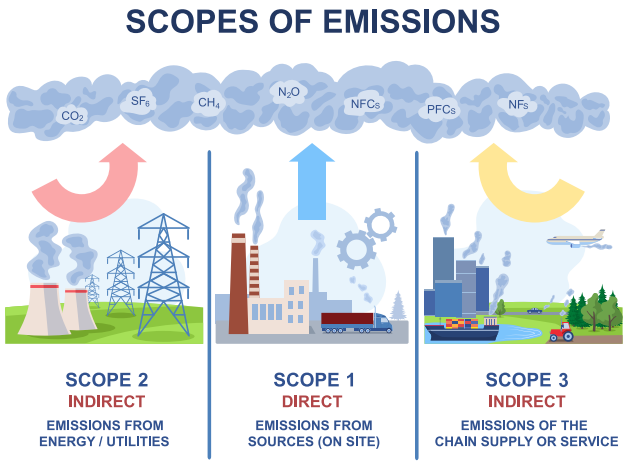

Figure 1. Scope 2, as set forth by the US Securities and Exchange Commission (SEC), will likely set a precedent globally for pipeline companies on emissions measurement and reporting.

Pumps can be operated by devices such as electric motors powered by hydroelectric or solar, diesel power or gas turbines with station facilities usually constructed every 20 miles to 100 miles along a pipeline's route, based on characteristics such as type of product being transported and terrain.

According to the GHG Protocol, nearly 40% of global greenhouse gas emissions can be traced to energy generation, and half of that energy is used by industrial or commercial entities. It is within this landscape that companies are being challenged to identify and understand the risks and opportunities associated with emissions from purchased and consumed electricity.

The novel SEC rules, while not seeking to prescribe any particular tools, strategies, or practices concerning climate-related risks, instead establish a framework for providing material information to inform investors and public stakeholders' understanding of impacts on a reporting company's business, results of operations, or financial condition.

In brief, the entire carbon intensity supply chain and GHG management paradigm have been effectively boiled down to individual company's responsibility to act, with the push toward net-zero emissions targets and carbon footprint reduction.

Pipeline companies are being asked to demonstrate their diligence and reduce energy consumption, and at the same time maintain profitable operations. Better emissions monitoring and reporting are being developed based on customer preferences for meeting all requirements.

Targeting power reduction

Beyond the capital expenditure associated with new pump station development and required maintenance, electricity usage represents a significant price tag. Reducing it often comes to mind as a logical first step.

Developing the necessary infrastructure that can optimise the number and locations of pump stations along pipeline routes can go a long way toward cutting expenditures, as well as emissions. Optimising performance through equipment or control system changes in tandem with software implementation for monitoring or enhancing a pipeline's overall capabilities is one approach to meeting all technical requirements, complying with laws, and maintaining profitable operations.

The new SEC rules build on reporting frameworks like the GHG Protocol, pointing to the imperativeness of disclosing key features of the contractual instruments that companies use to enable a clear understanding of the market context related to their energy purchases and a meaningful assessment of procurement strategy.

Enterprise engineering employs data analytics to promote peak operating performance, improve efficiency, and minimise this consumption. Cost savings and emissions reduction potential have been realised by turning off units and reducing the number of required pump stations.

One pipeline company reported using engineering software to make notable improvements, reducing electrical load by over 51 000 KWh through active management of a programme focused on avoiding using electricity during peak hours. The same company, with no compromise to product quality, was able to save 1.3 billion KWh of electricity – equivalent to avoiding 707 000 t CO2e – through decreased reliance on the energy usage required to operate pumps.

Figure 2. Emerson's software helps identify the optimal combinations and speed of electric pump drivers to achieve higher capacity while ensuring emissions reduction and profitability goals are met long term.

In other words, a direct link has been identified between lowering operational costs and reducing emissions along pipeline routes.

Pump efficiency and DRA

DRAs (drag-reducing agents) are expensive, an additional hard cost of running a pipeline. They are injected to ease the flow of crude oil or refined products, reducing the amount of operational pressure and energy usage required, increasing the throughput of the pipeline, or a combination of the two.

Companies that are making improvements to pump efficiency and optimising the use of DRA additives, are maximising the overall performance and effectiveness of pipeline systems.

Robust software aids in determining the optimal quantity of DRA needed to reduce operational overhead. This starts with looking closely at each pump station and how much energy each unit consumes.

Another pipeline company reported combining DRA technology and engineering software with process optimisation, resulting in optimised product movements, automated DRA and additive injections, and decreased power usage and costs.

The amount of energy consumed during the delivery of their products was reduced by 8%, on a volume basis, from 2018 to 2021. The Scope 2 emissions factor was also reduced by cutting energy usage, through DRA additives that decreased friction between petroleum products and their internal pipeline walls.

When optimising to meet an emission-based objective, more DRA will likely be used to moderate friction and improve the throughput and velocity of transporting products through a pipeline, while keeping movement costs as low as possible. However, this DRA increase is likely to be minimal overall.

Regulatory scope and essential monitoring

The SEC has pegged its Scope 2 initiative, contextualising it as a continuous improvement process. External parties – including customers, investors, regulators, shareholders, and others – are increasingly interested in emissions reductions that are vetted and verifiable through documentation.

To calculate indirect emissions, the GHG Protocol cites the Corporate Standard recommendation, which involves multiplying activity data (MWhs of electricity consumption) by source and supplier-specific emission factors to arrive at the total GHG emissions impact of electricity use.

The US national weighted average CO_2 marginal emission rate is used to convert electricity reductions into a measurement of avoided units of carbon dioxide emissions. Calculations are defined by the electricity consumed in kilowatt-hours.

Regulators are emphasising quality criteria for transparently disclosing information about energy purchases and obtaining reliable data sources for measuring emission factors from a market- or location-based metric perspective. To be considered a reliable data source, contractual instruments must meet Scope 2 quality criteria.

Various and different regulatory requirements and contracts, especially when crossing regional and state lines, make the ability to customise each pump to align with any given geographical area's emissions factor imperative. Moreover, trends can change over time, based on factors outside of a pipeline company's direct control.

Electricity supplier quotas for renewable energy, in addition to emission policies and regulations, and collective impacts of energy efficiency or voluntary demand for renewables, over time, may each come into play.

Multi-objective mathematics equations and optimisation is notoriously challenging. Flexible software with various modes allows users to toggle and choose between supporting a cost-based objective function or an emissions-based one.

These software enhancements facilitate the monitoring and minimisation of Scope 2 emissions resulting from the generation of electricity at each pump station.

Software data collection can assist with removing the guesswork. Integration of data-driven applications for monitoring and reporting, from a cost savings or emissions reduction point of view, or both, can be made simpler and more effective based on customer preferences.

Flexible optimisation

It has been standard practice to minimise operational cost accumulated from the power usage, fuel-based or electrical, used at pump stations over a specified period of time on a pipeline.

Emerson's optimisation software calculates an estimate for the carbon footprint of individual pump stations on a pipeline, for a specified period. This estimate allows for an objective study to see what the differences actually look like and provides insights on actual changes to overall energy costs.

It presents a configurable solution and unique resolution, allowing operators to monitor each station, aligning for the appropriate emissions factor based on how electricity is being sourced and used. A multiplier for each station can be set and customised based on how the energy used to operate the pump is generated.

It is noteworthy that meeting operational and business goals, and the potential to streamline objectives, is based largely on what pipeline companies are trying to minimise, keeping in mind both short-term targets and long-term goals.

Traditionally, only one function at a time has been set for optimisation. One imperative for approaching the new low carbon economy is assurances that advanced software solutions are

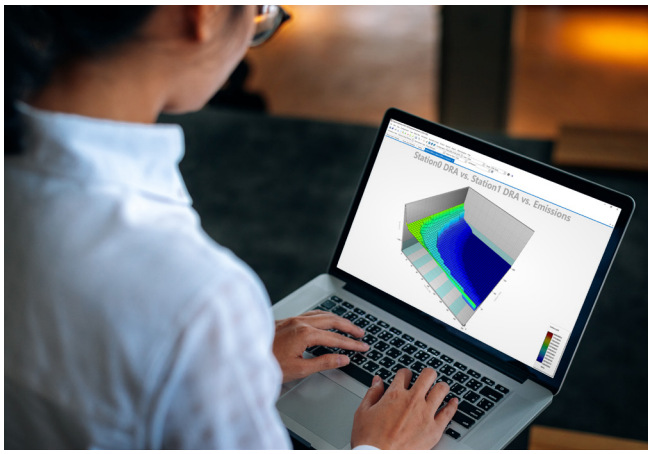

Figure 3. Users can visualise pump data with Emerson's optimisation software to better monitor Scope 2 emissions while also minimising the same emissions with pump unit selections and optimised DRA injection rates.

developed and can fully manage and model different scenarios, various compositions of fluids, and a wider mix of energy products, both now and in the future.

A system designed around preferences and integrability – for tasks ranging from leak and rupture detection to batch tracking, modelling and applications for improving flowrate – can be optimised for cost- and emissions-based objective function duplexity. This may be suitable for satisfying certain regulatory requirements and meeting a range of alternate needs.

A transparent view

According to the GHG Protocol, from a risk and reputation management perspective, "transparent disclosure about a company's energy procurement and its key attributes in the market-based method can help clarify a company's strategy and rationale."

Many pipeline companies that seek methods to clarify their strategy and rationale look into energy conservation and the 'greening' of operations, viewing cost savings and power usage energy reduction from a cleaner energy future perspective, discovering added value.

Optimisation is crucial for success in the oil and gas industry for determining risk preferences and uncovering benefits that have the potential to outweigh certain challenges. The ability to know ahead of time what the estimate of value for power costs is, to move additional volume over a specified time, helps decision makers more easily manoeuvre through these complexities.

A key indicator of fewer emissions is a reduction in operational costs. From a competitive standpoint, consistent emissions monitoring and transparent reporting enable more predictable and ongoing comparisons with industry peers.

Accurate monitoring and reporting have been deemed essential, demonstrating a best practice that can differentiate companies across an increasingly cost- and environmentally conscious marketplace.