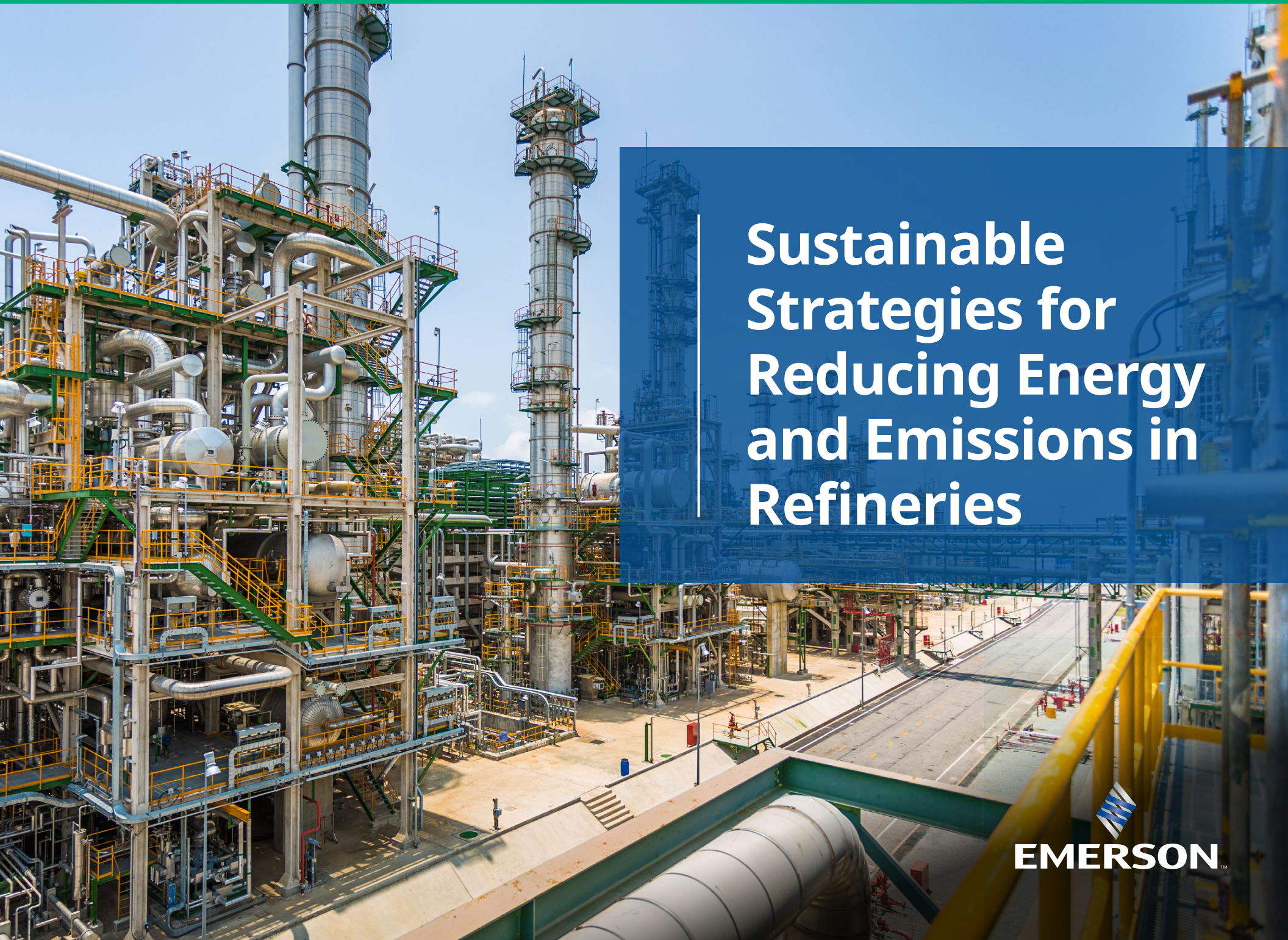
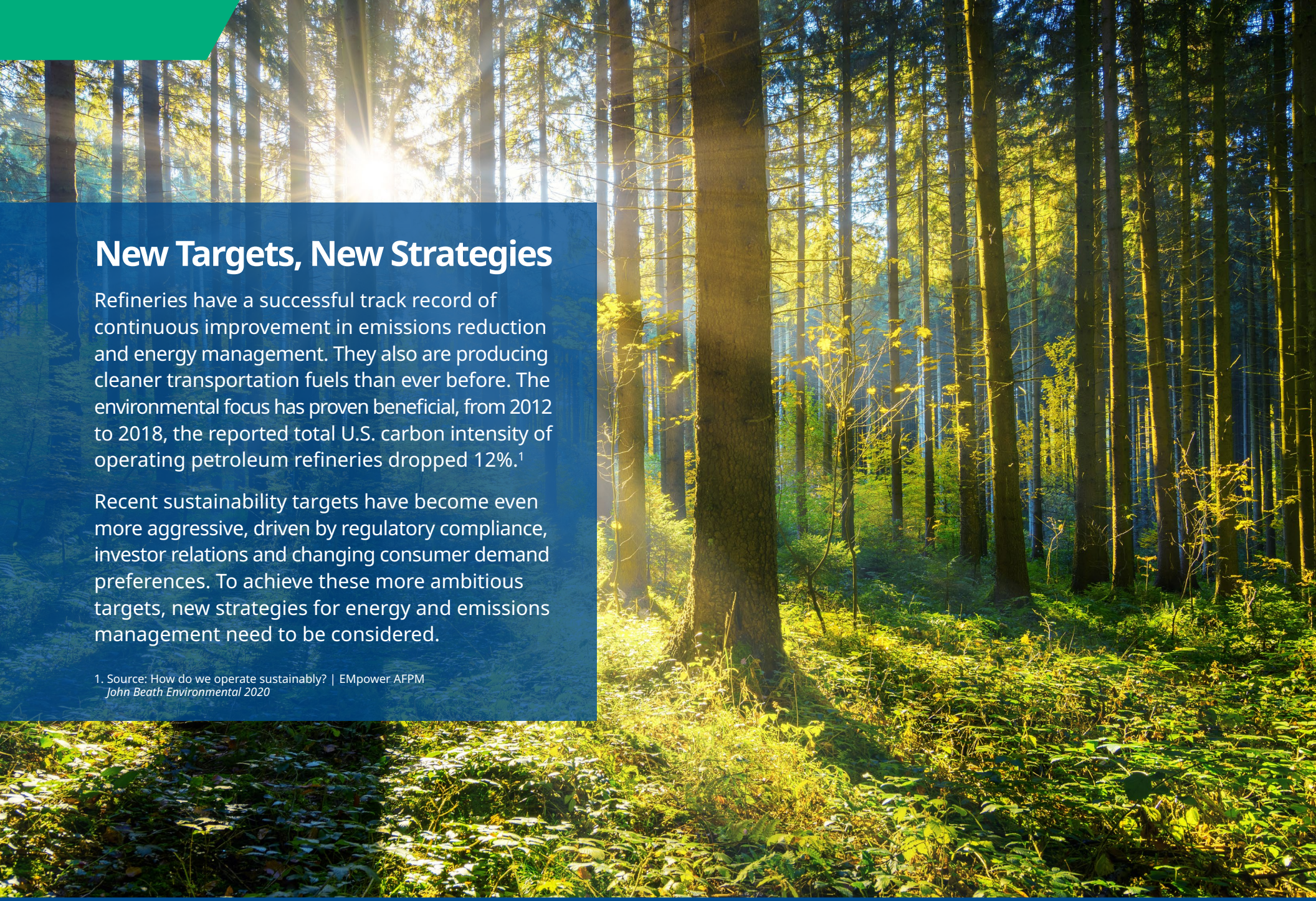


Sustainable Strategies for Reducing Energy and Emissions in Refineries

EMERSON

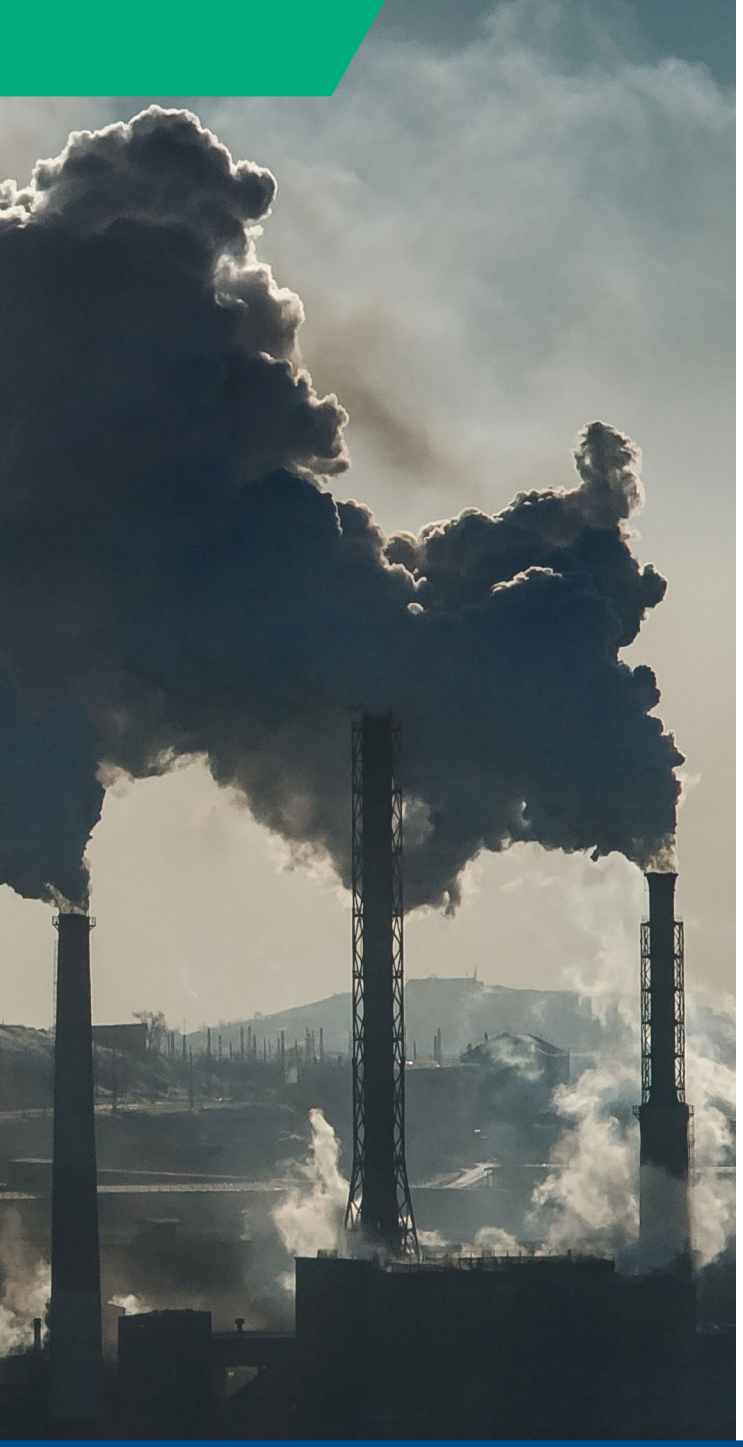


New Targets, New Strategies

Refineries have a successful track record of continuous improvement in emissions reduction and energy management. They also are producing cleaner transportation fuels than ever before. The environmental focus has proven beneficial, from 2012 to 2018, the reported total U.S. carbon intensity of operating petroleum refineries dropped 12%.[1]

Recent sustainability targets have become even more aggressive, driven by regulatory compliance, investor relations and changing consumer demand preferences. To achieve these more ambitious targets, new strategies for energy and emissions management need to be considered.

1. Source: How do we operate sustainably? | EMpower AFPM *John Beath Environmental 2020*



Many Strategies and Paths to Sustainability

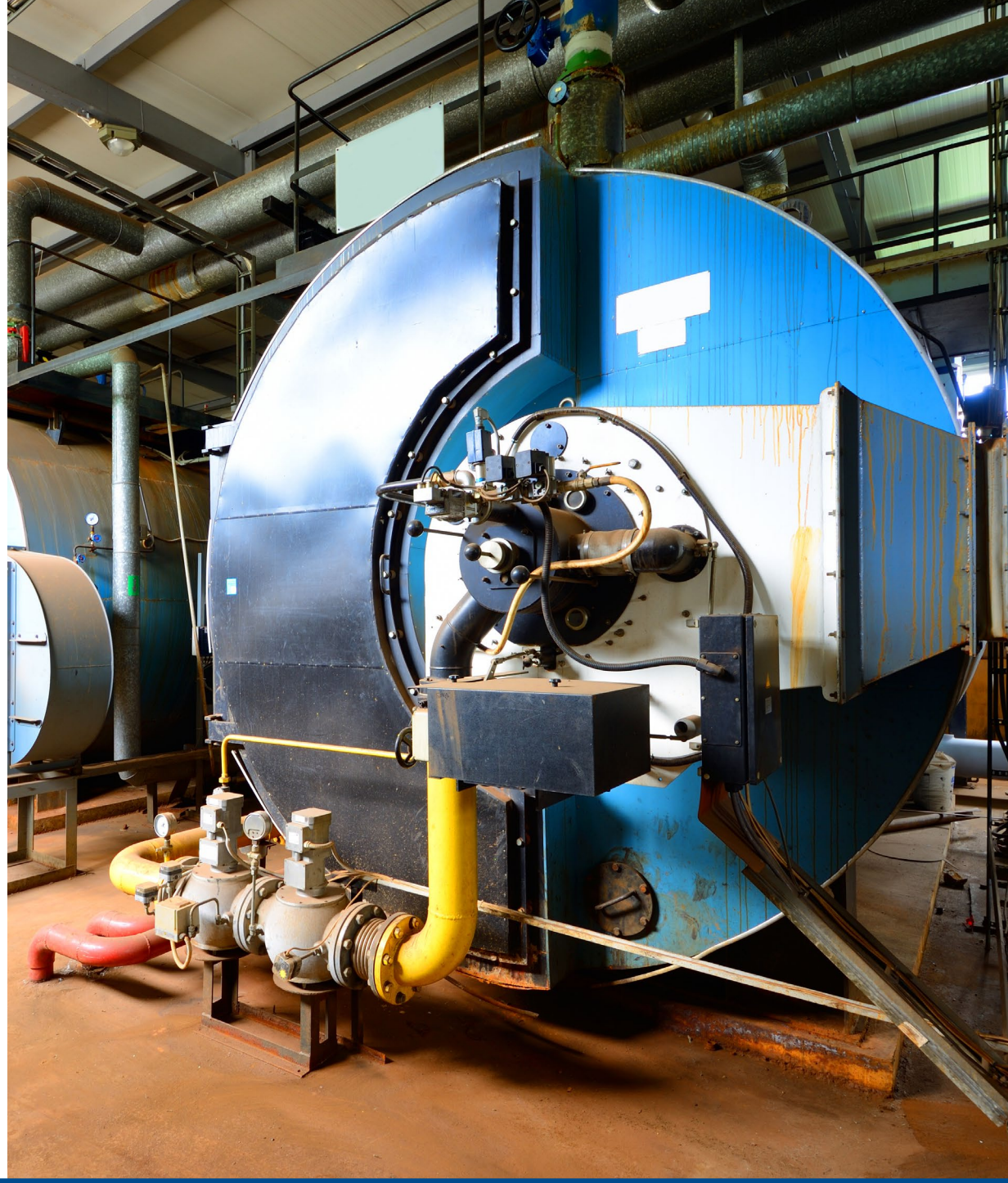
With the advancement of process and automation technologies, refineries today have more data-driven, digital, and economical tools and tactics they can utilize to more proactively tackle their energy and emissions management improvement initiatives. Achieving sustainability targets will be a multi-faceted approach, ranging from futuristic investments in new technologies such as carbon capture and storage, to improving existing operations by adding extra measurements to monitor equipment health in the field, to cloud-powered data analytics to predict and analyze asset performance in real-time.

- Addition of or conversion to clean fuels production
- Cloud-powered data analytics for equipment monitoring and energy management
- Predictive emissions monitoring
- Carbon capture and storage
- Water management
- Wireless sensors to monitor heat exchangers, steam traps, pump health, etc.
- Advanced process control of heaters, boilers, distillation columns, etc.
- Optimizing or converting from grey to blue hydrogen production
- Fugitive emissions monitoring from valves

Leveraging Analytics for Smarter and Dynamic Energy Management

Energy costs can vary based on fuel type, cost, boiler efficiency, steam pressure and more. Using a combination of artificial intelligence and principles-driven analytics for real-time energy consumption monitoring, can increase visibility to energy management key performance indicators (KPIs) and insights to dynamically optimize consumption with production.

Identify energy performance gaps earlier, pinpoint root causes and use analytics to provide optimal settings to minimize energy consumption and costs.



Emissions Reduction by Stabilizing Control of Fired Heaters

With over 60% of greenhouse gas emissions from a refinery emitted from combustion processes and around 60 –70% of fuel used by heaters, process heaters provide a significant improvement opportunity. Reliable and accurate air-to-fuel-ratio, flow control, and stack oxygen and combustible concentration measurements, combined with advanced control solutions, lowers excess air and stabilizes heater outlet temperature.

Mass-based combustion control of fuel gas using Coriolis flow meters is more proportional to the energy content of gas and maintains stable control, despite fuel gas quality variations, when compared to pressure or volume-based control schemes.

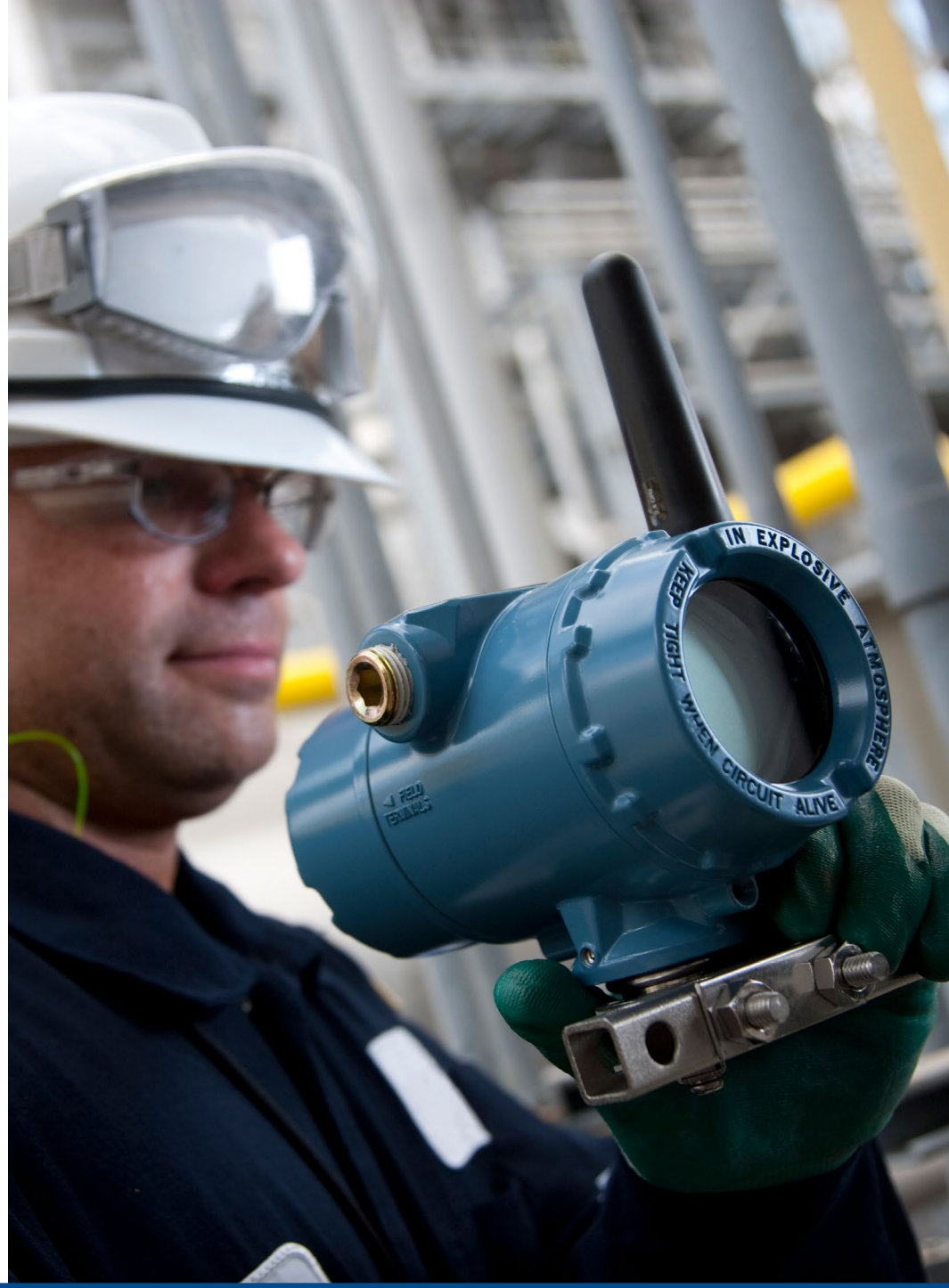
Advanced combustion controls in the regulatory control layer provide safe and efficient operation, with further efficiency gains possible by leveraging model predictive control technology.

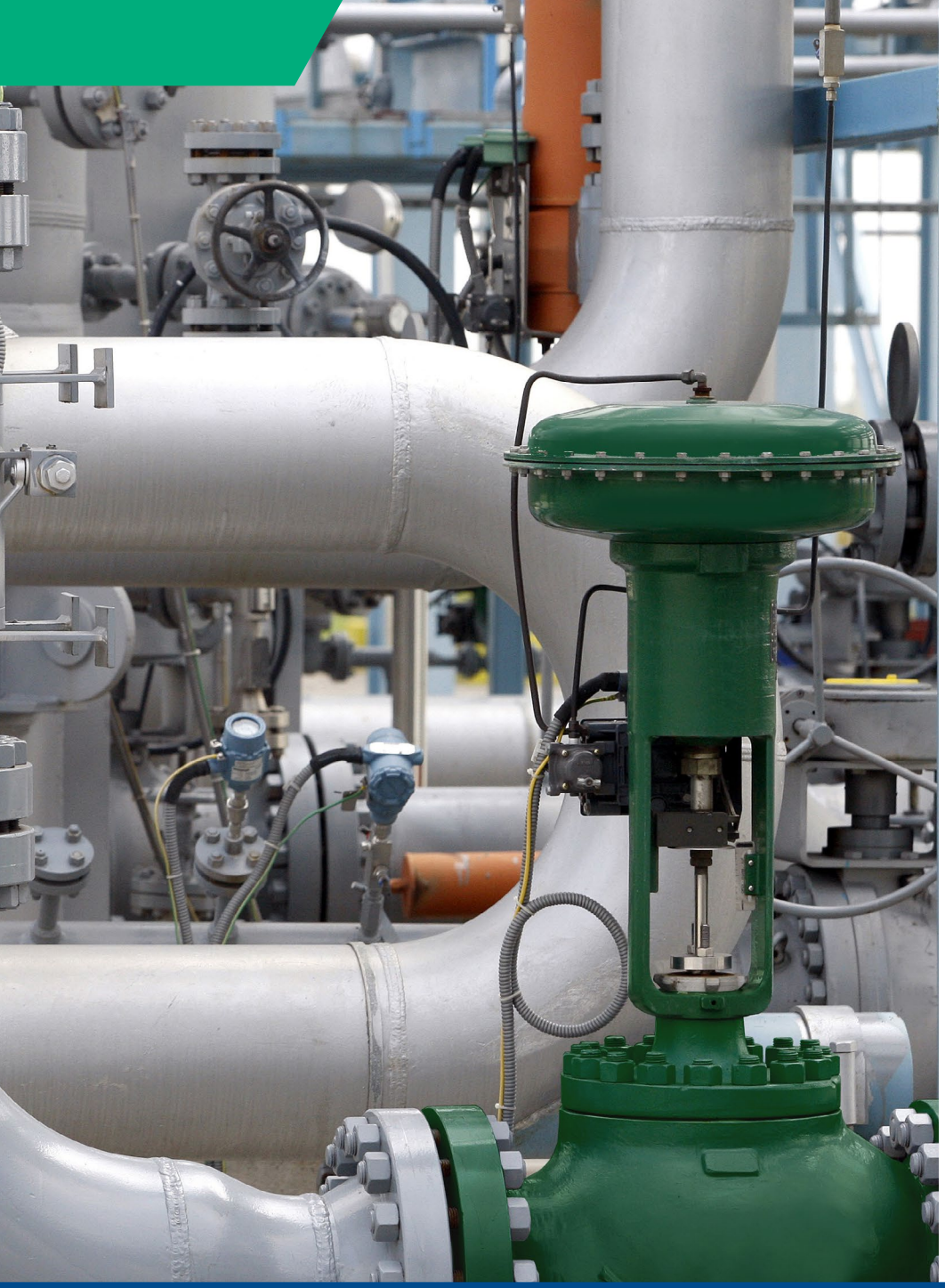
Monitoring Equipment Performance and Sustainability KPIs

Real-time monitoring of assets such as pumps, steam traps and heat exchangers, using wireless sensors and pre-built analytics solutions, has traditionally been used to support maintenance practices, but these applications can also provide sustainability KPIs.

Implementing wireless temperature, pressure and flow sensors, combined with pre-built analytics to calculate lost energy on heat exchangers, enables you to track efficiency and schedule service.

Leveraging wireless acoustic monitoring for early detection of leaking steam traps can help lower boiler utilization and water use, and provide data to calculate carbon reduction.





Reducing Continuous Fugitive Emissions

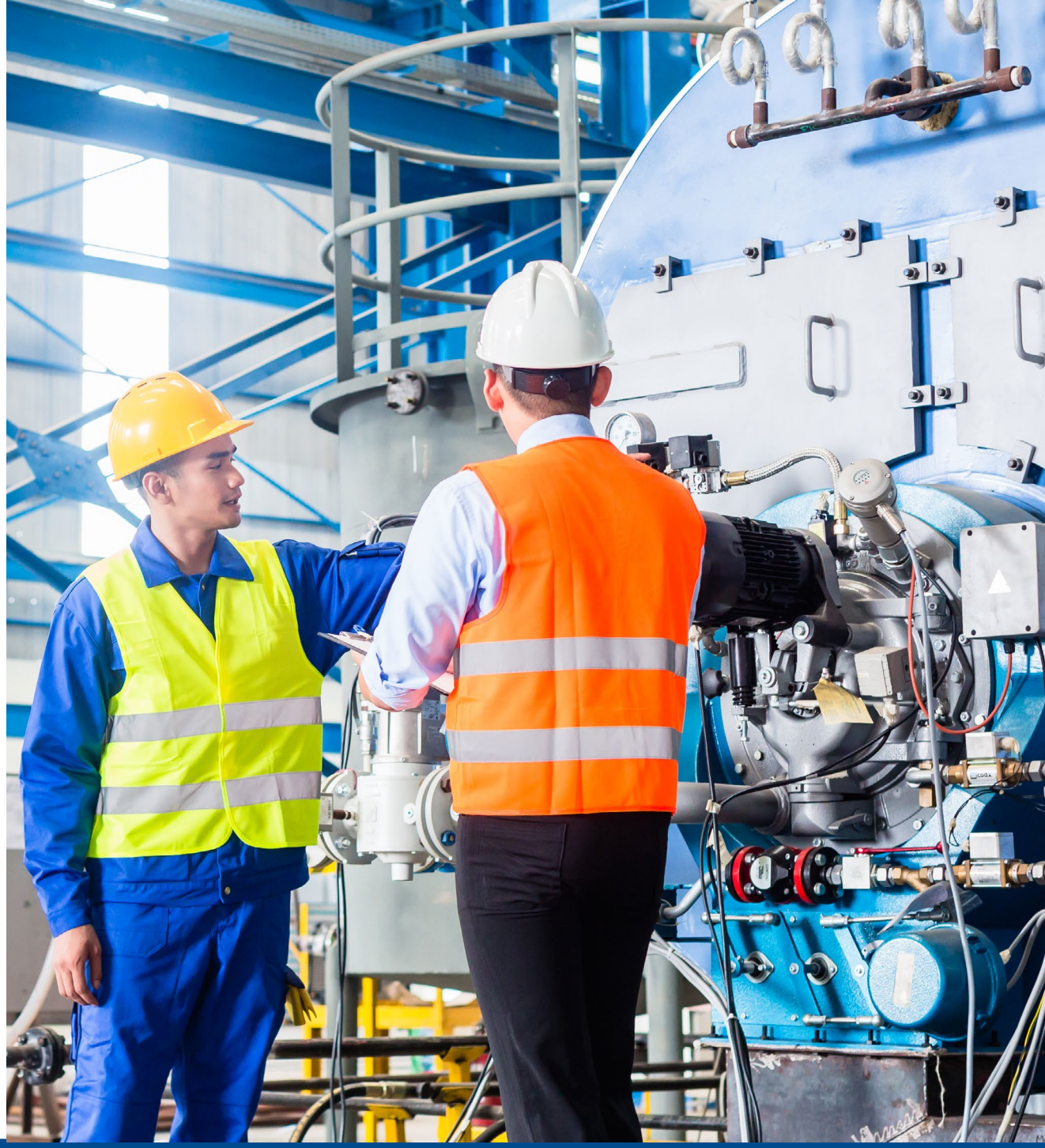
Continuous fugitive emissions result from plant infrastructure, such as isolation, control and relief valves, tanks, flanges and pumps. These leaks, which are due to incorrect sizing, configuration, installation and maintenance, can be very difficult to detect. Ambient conditions and large monitoring areas contribute to the challenge and when aggregated become the greatest contributors to overall emissions. Without regular monitoring or inspection, these leaks can often go undetected over time until they become problematic/dangerous.

Modern valves are fugitive emissions compliant by design, with high levels of tightness and durability. Correct selection, sizing and lifecycle maintenance contributes to lower emissions.

Smart technology, such as intelligent valve positioners and acoustic wireless sensors, enables monitoring and reporting of short duration upsets that can lead to small and/or unnoticed emissions.

Ways to Get Started

- Generate an emission benchmark assessment with calculations, recommended technologies and practices for energy balance improvements. Leverage Emerson's consulting services.
- Develop a business case for equipment monitoring or fired heater combustion control solutions. Emerson can help.
- Inquire about Emerson's energy and emissions management solutions. Contact your local sales representative to learn more.



With a need for industry to manage and reduce emissions, we continue to develop solutions and provide expert advice to identify and eliminate issues and achieve the necessary improvements that ensure regulatory compliance and long-term business sustainability.

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