

Clean Fuels Require Real-time Chemical Analysis

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Keywords

Clean Coal Technology, Clean Fuels, Process Analytics, Process Intimacy, Real-time Chemical Analysis, Ultra Clean Motor Fuels

Summary

Global demand for fossil fuels continues to rise despite the regulatory pressures to reduce emissions generated by burning such fuels. With economically viable and commercially available alternative clean fuel sources still somewhere in our future, the only alternative currently available is to clean fossil fuels. Reliable, accurate, and robust real-time chemical analysis is an integral component of clean fuel production.

Analysis

Clean air is vital to our health and our environment yet the fossil fuels on which we so heavily rely for our energy needs produce massive amounts of harmful emissions. Countries around the globe are responding to impending environmental and health crises with clean fuel initiatives that support development and adoption of cleaner fuel standards for gasoline, diesel fuel, and coal. Production of clean fuels requires real-time chemical analysis to improve product quality, reduce the cost of manufacture, increase operational efficiency, and meet regulatory requirements.

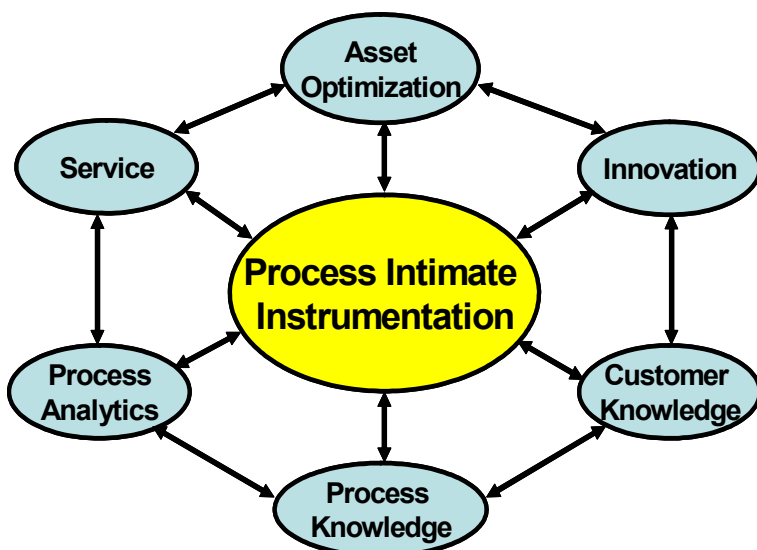
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Thermo Electron Corporation is in a unique position to supply the energy industry with technology for real-time chemical analysis. Thermo leverages its world-class detection technologies to give end users a deeper understanding of their processes in real time than traditional temperature, pressure, flow and level measurements can provide. On-line industrial analyzers as offered by Thermo provide the benefit-driven analytical solutions for continuous quality control without going to the laboratory.

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Elements of Process Intimate Instrumentation

provide industrial analyzers and instrumentation that meet the challenges of real-time measurement with accurate, robust, and user friendly analytical instrumentation.

Process knowledge involves the technical expertise of the physical and chemical properties needed for accurate and reliable chemical analysis as well as the familiarity with user requirements to convert data into usable information that is available when and where it is needed. Real-time chemical analysis requires analytical techniques that are fully integrated with process automation systems to support 24/7 operation. It is process knowledge that makes Thermo uniquely qualified to

Clean Coal Technologies

On a cost per million Btu basis, coal is the lowest cost form of energy. About five billion tons of coal are mined each year worldwide. At present consumption rates, proven coal reserves are projected to last over 200 years. In contrast, proven oil reserves are expected to be depleted in 40 years and natural gas in an additional 70 years. Coal is a more available and geographically evenly distributed source of energy. The challenge is to develop technologies that can identify and measure harmful pollutants found in coal as well as technologies that can eliminate or sequester those pollutants.

A new generation of technological innovations referred to as Clean Coal Technologies (CCT) are emerging that are designed to minimize the environmental impact of coal extraction, preparation and use. CCTs can take the form of new combustion processes, pollution control devices, and techniques to convert coal into other forms of fuel that reduce emissions and waste while increasing the amount of usable energy.

Coal quality is an important factor in determining a particular coal's economic viability as variations in quality can adversely impact the cost of coal

production and power plant operation, coal's primary use. In addition, knowledge of coal's sulfur and other trace elements is essential for regulatory compliance.

Coal Quality Parameters	Impact
Ash Content	Net energy per ton Ash disposal costs Maintenance costs
Moisture Content	Net energy per ton Dust control Coal handling
Sulfur	Flue gas emissions Precipitator performance
Ash Constituents	Potential for fouling Ability to precipitate Ash disposal

Major Coal Quality Parameters

Thermo Electron's Gamma-Metrics Coal Quality Manager (CQM) is a CCT as it enhances the combustion process. Traditionally, coal sampling methods rely on statistical analyses that do not accurately represent variances within the batch. Thermo's CQM provides coal producers and users with the ability to measure heat content and environmental parameters on a real-time basis to optimize burning efficiency and simultaneously minimize harmful emissions.

Process knowledge enables Thermo to apply its CQM to new applications such as controlling ash fusion temperature where real-time measurement of ash constituents is required in order to minimize forced outages.

Ultra Clean Motor Fuels

High concentrations of sulfur in transportation fuels have been identified as a source of environmental pollution and respiratory related health issues in people. The US Clean Air & Water Act of 1999 includes a Tier 2 Vehicle and Gasoline Sulfur Program designed to reduce sulfur content in gasoline and diesel fuel by up to 90 percent. In the final phase effective June 1, 2006, sulfur content of gasoline will be reduced to 30 parts per million (ppm) and 15 ppm for highway diesel fuel.

As a result of these new regulations, refineries must meet stringent specifications for lower sulfur content. All refiners are making significant investments in new or upgraded clean fuels production equipment. Refiners processing price-advantaged heavy sour crudes face even greater challenges as they must produce clean fuels from feedstocks laden with sulfur. Total refining industry investment for production of low-sulfur fuels is estimated to reach \$20 billion.

Pipelines and terminals frequently employ a common infrastructure to distribute a broad range of refined petroleum products with varying sulfur

content presenting pipeline and terminal operators with a different set of challenges. Real-time measurement of sulfur concentration will be required to avoid contamination of low sulfur fuels.

Thermo's SOLA II sulfur analyzer provides visibility into the various processes involved with refining, blending, and transporting fuels such that an operator can observe ppm or ppb levels of sulfur without going to the lab. In the refinery, SOLA II is an on-line analyzer for accurate determination of total sulfur content of either liquid or gas samples to enhance the efficiency of desulfurization and fuel blending operations. In the distribution network, SOLA II can be employed on-line or at-line to ensure that ultra low sulfur motor fuels are delivered to market in compliance with EPA regulations. Operators are able to determine the sulfur content of fuels entering the pipeline network, identify sources of sulfur contamination, and enable rapid fuel blending to avoid downgrading of ultra low sulfur fuels.

Conclusions

- Thermo Electron's drive to provide higher levels of process intimacy to its customers provides an excellent foundation for the development of practical solutions by applying its unique analytic and measurement domain expertise. Thermo's mission of developing environmentally friendly solutions through close collaboration with its user partners can also be applied to other industries to make the world a healthier, cleaner, safer, and more productive place.
- Thermo Electron's approach to process intimacy is in sync with ARC's Real-time Performance Management (RPM) concept. Its in-depth process knowledge of chemical analysis enables operators to measure analytical details about their processes in real-time and thus improve performance.

This paper was written by ARC Advisory Group on behalf of Thermo Electron Corporation. The opinions and observations stated in the paper are ARC's. For further information or to provide feedback on this paper, please contact the author.