Center for Process Analytical Chemistry (CPAC)

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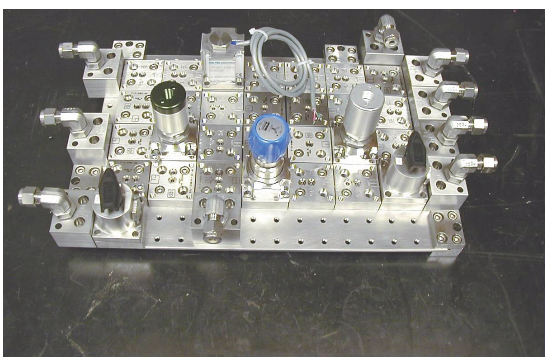
New Sampling and Sensor Initiative (NeSSI™)

Although process analyzers have undergone significant technological advances recently, the systems that deliver samples to them have hardly changed in the last fifty years. An initiative, launched in 2000 by the Center for Process Analytical Chemistry (CPAC), is primarily concerned with the treatment and continuous analysis of samples extracted from process equipment. NeSSI™ provides specifications, guidelines, and a forum for the on-going development of a Lego®-style building block platform for analytical systems. It was widely recognized that CPAC's leadership had developed NeSSI™ into a valuable global ad hoc initiative comprised of end users and suppliers and is resulting in permanent changes within the process analysis field. It has now been commercialized by several hardware manufactures and is being specified on major new-build projects. Several engineering companies now provide networked connectivity for all components of the NeSSI™ platform, opening the door to smart diagnostics and improved remote technical support. NeSSI™ is now used to enable improved process analytical measurements in the petrochemical, chemical, and oil refining industries and is being studied for applications in the pharmaceutical and biotechnology industries.



Several engineering companies now provide networked connectivity for all components of the NeSSI platform, which reduce costs.

Economic Impact: These new NeSSI™ platforms are showing reduced costs (both in the cost to build and own) with increasing reliability, and hence the value delivered by process analyzers. The combined benefits to industry are growing and will soon be measured in tens of millions of dollars per year.

Non-Destructive Spectroscopic Measurement: Inline Octane Sensor

In-line, real-time measures of octane at refineries means fewer costly additives. This saves millions of dollars per day; an estimated $1.5 billion per year.

In the mid 1980s, the Center for Process Analytical Chemistry (CPAC) pioneered a revolutionary approach to octane determination in oil refineries. This still used ground-breaking new octane sensing method uses a non-destructive spectroscopic measurement followed by multivariate calibration techniques to predict diverse physical, chemical, and consumer properties of fuel. This industry-changing advance was possible because the spectrum of the material clearly reveals the number and types of functional groups (e.g., methyls, methylenes, olefins, aromatics). In combination these determine gasoline's physical, chemical, and consumer properties. As a bonus, the octane sensor can simultaneously predict a number of important properties of gasoline such as density, vapor pressure, and percent aromatics. All of these measurements are made nondestructively on one cc of sample. Results are available instantaneously. The approach has proven an invaluable adjunct to process analytical chemistry.

Economic Impact: At the time it was developed, this octane determination method represented a vast improvement over previous octane determination methodologies because octane levels were determined by rather antiquated ASTM-CFR test engines. In the test engines each sample's performance was compared to reference fuel blends. The instrumentation required for measurements was very expensive (over $100,000), required constant maintenance, needed frequent standardization, consumed approximately one pint of gasoline per test, and, most importantly, required 20 minutes to produce results. This breakthrough real time, in-line "octane sensor" methodology is still used in refineries worldwide because it quickly and accurately predicts octane levels from the near-infrared vibrational spectrum of the inline sample. Annual savings are estimated to exceed $1.5 billion in 2012.

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