A NEW PERSPECTIVE ON MEASUREMENT THE IMPACT OF MEASUREMENT IN A CHANGING BUSINESS ENVIRONMENT

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The measurement of hydrocarbons has evolved significantly through the years, from both a technical and business application perspective. Developments and advances in technology have made the measurement of hydrocarbons more precise, efficient and available. Changes in the energy business environment have placed the measurement of hydrocarbons into a more significant role within organizational and industry business processes.

A HISTORICAL OVERVIEW OF THE NEED TO MEASURE

The Roman's discovered the value in measuring and controlling the flow of water throughout the aqueducts of their cities in order to better manage resources and serve the needs of the populace. The Chinese first developed pipeline systems made of bamboo and wood to transport hydrocarbons and water from supply regions to consumption areas. These early concepts and applications of natural resource acquisition, delivery and management were provisional to the needs of primarily Agrarian societies. The resources were consumed within the context of meeting the basic needs of people within the scope of their existence.

The onset of the Industrial Age changed the value and applications of the available natural resources to societies. No longer were these resources only applicable to agriculture, cooking, and lighting (via torches and lamps). These resources now were used as energy sources to ultimately create products and power. Oil and gas could be burned to create steam from water, which in turn could be applied to drive machinery that could produce more work output than humans alone.

As the properties of hydrocarbons became better understood, such could be processed and refined into sub products that had even greater uses. These products could be used as raw materials to create other products, such as textiles, fertilizers, chemicals and additives for other products, or as end products such as fuels. As the uses for hydrocarbons grew, so did the value. The measurement of hydrocarbons and the subsequent refined products began to take on greater importance because of the increased value of such.

One of the greatest technological innovations that dramatically affected the hydrocarbon industry was the invention of the internal combustion engine. This invention enabled the direct use of hydrocarbons as a fuel to power machinery. Since the energy contained within the hydrocarbons could be directly utilized to drive the machine, rather than indirectly as with the generation of steam, machines became more compact and mobile. Machines became available to virtually everyone as an affordable means of transportation, such having revolutionized the means by which the entire world functions.

But the key to it all was still the hydrocarbon. The hydrocarbon based fuel must be available to operate the machinery around which the world functions. This has given even greater value to the hydrocarbon and the ultimate measurement and quantification of such. As technology has continued to advance, not only are the quantities of hydrocarbons important, but the composition and quality of the hydrocarbons as well.

MEASUREMENT IN THE "OLD" ENERGY BUSINESS

The "Energy" business was born per the Industrial Age. Fuels were needed to power machines. An entire industry evolved from the need to discover, gather, transport, refine and deliver fuels. Because these fuels were of value, such had to be measured.

The measurement of fluids was accomplished by physically determining the amount of the fluid that passed a given point. The principals of these measurements were founded in applying the physical properties of the fluids to the principals of geometry and physics of the medium in which the fluid traveled. These measurements were part of operating the transport systems to move the fluids from one point to another.

The measurement of fluids was accomplished by strictly mechanical means. The most common means to measure was by passing the fluids though a restriction to create a pressure drop. The drop in pressure would be measured and related to the conditions under which the fluid was contained and a rate of flow determined. Devices were developed to record the measurement of pressure drop (differential pressure), static pressure, and temperature of the fluid. These recordings were then interpreted in relation to time in order to determine quantities.

The most common means of measuring hydrocarbon fluids became the orifice plate. A thin plate was placed in the pipe. The plate had a bore (usually concentric within the plate and pipe) through which the flowing fluid would pass. The pressure on each side of the plate would be measured to determine the pressure drop. This means

of measuring the flowing fluid proved very reliable in that the systems withstood very harsh conditions and required little maintenance.

Other types of meters were also developed to measure hydrocarbon fluids. Turbine meters, wedge meters, displacement meters and others began to become commonly employed to measure hydrocarbons. All were mechanical systems and were employed per the conditions that existed relative to the needs and quantities of the fluids to be measured. The systems employed to record the measurements of the fluids were also of strictly mechanical means, and required subsequent interpretation to determine quantities.

Measured quantities of hydrocarbons were then reported to administrative groups within the energy organization. The accountants would then apply the price per unit of fluid to the total quantity for the time period and a statement would be forwarded to the party with which the transaction took place. The process was no different than any other business transaction, such as dry goods or groceries. The product was priced, the quantities measured or counted, the total price determined and the transaction finalized. The sequence of events in creating and finalizing the transaction were fixed and very simple. A to B, B to C, C to D, and so on. The need to measure or count units was just a necessary step in the process and was a physical function left to those who operated the pipeline systems.

These were the means by which the energy business and the measurement of hydrocarbons existed for many, many years. Subtle changes would occur per the development of some new mechanical measuring or recording systems, but for the most part, no significant impacts were realized as far as the role of measuring within the organization.

AN EVOLUTIONARY STEP

Along came the microprocessor, a small silicone based chip that could perform a multitude of mathematical functions that normally required the efforts of many people operating many machines to reach the same result. Computing had been around for a while, but such was not available to everyone. Large mainframes dominated the information management world and the use of such was limited in scope to the rigid structural environment of the system. Mainframe time was limited and expensive. The PC microprocessor introduced affordability and accessibility into the equation.

Until this time, hydrocarbons were traded virtually in terms of only quantity. “How much” was the only real issue. Content of the quantity and how much total energy was available were not so important. Gas was still cheap and the determination of quantities was very labor intensive. Detailed determinations of compositions and energy values were even more complex and had marginal monetary value to the transaction.

This all changed in 1978 per the passage of the Natural Gas Pricing Act. This legislation was the cornerstone for the means by which natural gas is traded today, in terms of energy rather than just quantity. Sudden and dramatic increases in the value of natural gas, as well as other hydrocarbon based fuels, brought to light the need to consider the quality of the product, not just the quantity. It became the difference in buying a bicycle or a sports car. Both are transportation vehicles to get you from point A to point B, but one has significantly more features and performance characteristics than the other, and thus, the difference in value to the consumer.

Now natural gas was exchanged in terms of BTU’s or Therms. The total amount of energy delivered was the basis for the transaction. Computing equipment had been implemented into the business processes, but measurement still was very labor intensive.

MEASUREMENT AND ENERGY GO “HIGH TECH”

The introduction of the microprocessor meant a new era for measurement. Computers could now be employed to record measurements, calculate volumes, store information and communicate with other information systems. Microprocessors also allowed the development of gas quality systems that could be implemented at the measurement facility. Such instruments were previously limited to the central laboratory. Fluid composition and quality could now be determined “On Site”.

Various devices could be interfaced together in order to combine the recordings of measured physical variables, compositions and thermal values to render a total delivered energy quantity. This information could be made available to business units within organizations much faster in order that such could be applied to commercial transactions on a more timely and precise basis.

Energy could now be transacted upon in virtual “Real Time”. The historic waiting period to gain access to vital information because of energy measurement, data processing and information provision to business units had been reduced tremendously by the development and implementation of computing and information technologies.

The microprocessor also enabled new research and development to occur with existing primary measurement devices, as well as the development of new primary measurement systems. Greater precision could be obtained by employing newly developed measurement and calculation mechanisms per the acquisition and implementation of better research data. New primary measuring elements, such as ultrasonic meters, were developed for use in measuring fluid flows. Computing power enabled these meters to be implemented on a production basis because the huge amounts of data acquisition and processing required to precisely and successfully utilize these systems could now be accomplished.

These technologies that spawned the creation of new measurement, recording and communication systems created huge amounts of data to be managed. Client-Server based information systems were developed to efficiently receive, process, validate and transmit this information to business systems. More and better information could now be derived, processed and utilized with much less required work and human intervention.

ENERGY GETS "REAL TIME"

Readily available and precise information changed the scope of the energy business. Energy could now be traded in "Real Time". Precise quantities of energy could be transacted upon on a daily or even hourly basis, at different prices and under different conditions. The energy market place now resembled the stock market.

A key to this market concept being successful, though, was the integration of the measurement of products into the business cycle mainstream. No longer could measurement be maintained as an upstream process whose product slowly trickled into the business cycle for "end of period" processing. The function had to be an integral part of the dynamic process that enabled business to be conducted and finalized "Now". Huge monetary benefits to all interested parties were at stake. Not only was measurement an engineering and operations process, but now a vitally integrated business necessity.

Because of this new integration into the business relationship, measurement personnel had to be more knowledgeable of the energy business process. Also, personnel had to have greater cognizant understanding of other business processes, such as accounting, finance, contract administration and commodities trading practices and implications. Measurement was now a truly "Business" process, not just another step that was necessary in the core operation of the pipeline system.

This also created a need for measurement personnel with new skills and education. Not only were engineering and operations principals important, but also proficiencies in business disciplines and processes. The new "Measurement Man" was now required to wear more hats, have broader understandings of the entire engineering, operations and business processes, and continually develop new proficiencies as technologies and businesses practices progressed.

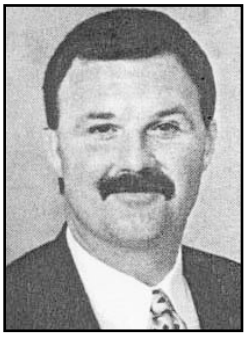
Discussions among today's industry measurement managers not only focus upon the engineering and operations aspects of the process, but as much upon the business related implications of the measurement processes as well. Highlighted topics at today's industry conferences are often the impact of LAUF (Lost and Unaccounted For) product, minimizing the "after the fact" processes of having to "scrub" measurement data in order that such may be immediately applicable to current business transactions, and the continuing development and implementation of measurement information technologies that are integrated directly into the primary business system platforms of the organization.

ENERGY MEASUREMENT AND THE FUTURE

So where does measurement go from here? What are the important aspects of the entire measurement process in relation to the dynamic environment of today and tomorrow's energy business? These are issues that shall be explored, defined and implemented by energy measurement professionals.

All of the answers are not currently known, but there is one significant aspect of the energy business environment that will be at the top of the agenda. Industry measurement professionals must work in concert together in the development and implementation of measurement technologies, applications and practices. No longer is any energy organization an "island". Industry wide participation and acceptance must be achieved in order to ensure that energy measurement is, and continues to be, performed with technical, business and ethical integrity.

This concept will not be limited to energy in America, but will have global implications. Energy today, all energy, whether raw or produced, is a global commodity. Industry organizations worldwide are working to develop standards and practices that are globally applicable and acceptable. Today and tomorrow's measurement professionals must actively participate within this endeavor in order to ensure that our industry and organizational interests, concerns and ideas are satisfactorily addressed and considered in order that the future of measurement in the energy operations and business environments is an integral part of the future energy industry.



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