

Achieving Business Value through Automated Gas Measurement

Executive summary

The increasingly complicated natural gas supply chain coupled with the growing demand for natural gas results in the need for operations tools that optimize information management and operations efficiency. This paper examines how automating gas measurement business processes adds value to operations data, avoids the inaccuracies that hinder accurate accounting, and enables good economic, environmental, and security-related decisions that support a business's efficiency and competitiveness.

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Executive summary

Deregulation and liberalization of the natural gas industry in the U.S. and Europe — and rising natural gas trade activity in general due to environmental concerns — are opening markets and increasing hydrocarbon movements. This globalization trend is resulting in an increasingly complicated natural gas supply chain that requires standard business processes to assimilate new best practices. As supply and sales interfaces increase, measurement and accounting systems must become more interoperable, accurate and secure to support efficiency and competitiveness.

An advanced, comprehensive gas pipeline measurement and analysis system can monitor flow rates and other pipeline parameters continuously and automatically validate, estimate, balance and edit measurements, with complete documentation. This robust functionality adds value for the enterprise in several ways. It makes accurate data available in real time to accounting processes to assure accurate energy calculations for billing and transactional balancing. Real-time composition determinations assure the operation is satisfying the contracted transaction with respect to quality metrics, including greenhouse gas (GHG) emission potential. Accurate real-time assessment of gas delivery vitals supports operations decision making.

The functionalities of such a gas measurement and analysis system enable best practices vital in today's more-complicated hydrocarbon transmission operations and transactions. The system provides the quantity and quality of measurements necessary for accurate accounting and billing. Validation functions are completed with full transparency. Estimation functions support system balance and avoid accounting closing delays. Continuous monitoring identifies equipment failures and supports effective maintenance. GHG data support reduction action plans. These value-added data are all made available in real time across the enterprise to improve productivity and competitiveness, operations efficiency, customer service and corporate governance.

Enabling best practices through advanced measurement and analysis system solutions

Introduction

Deregulation and the opening of energy markets has resulted in the worldwide unbundling of production, transmission, distribution, storage and supply of natural gas. The movement of hydrocarbons among countries worldwide is stepping up. This increasingly complicated natural gas supply chain coupled with the growing demand for natural gas results in the need for operations tools that optimize information management and operations efficiency.

Here, we discuss how automation of gas measurement business processes helps achieve those goals—by adding value to operations data, avoiding the inaccuracies that hinder accurate accounting, and enabling good economic, environmental, and security-related decisions that support the enterprise's efficiency and competitiveness.



Optimizing Information
Management and
Operations Efficiency

Opening of the market makes it 'complicated'

Worldwide trend

In 2004, the U.S. Federal Energy Regulatory Commission (FERC) deregulated the interstate natural gas industry, giving states jurisdiction of their respective markets. This FERC order resulted in the separation between ownership and operation of natural gas transmission and distribution infrastructures, allowing the customer to independently choose its most efficient and economical means of natural gas supply, regardless of the transportation system.

Europe, too, is following this course. The Third Energy Liberalization Package adopted by the European Commission in September 2007 targets the separation of production and supply from the transmission networks of large, integrated energy firms. The eventual goal is to establish a single European energy market from the 25 liberalized, but separate, national markets—a single market from which industries and even households can freely choose their energy supply.

Elsewhere around the world, natural gas trade among nations is rising. The recent gas delivery agreement between Russia and China, new gas routes such as the one connecting Africa and Europe through Spain, and recent projects such as the Nabucco pipeline planned to run from Turkey to Austria, exemplify the gas supply arrangements of today's world.

Changing the way we do business

As the world adopts a globalized market, these developments are inevitable:

- Increasing market opening, exportations, new entrants, and more competition which, potentially, will increase the diversity of supply sources
- Rapid increase in the number of sales and purchase possibilities as the sources of gas supply increase
- Greater need for more interoperability of systems
- Improved short-term supply security, as the systems and the market actors will have had to set up more flexible operating systems
- Scrupulous accounting in all transactions among all participants; for example, the company that moves commodities on behalf of the owner

Environmental concerns are increasing natural gas demands

Natural gas is an extremely important source of energy for reducing pollution and maintaining a clean and healthy environment. It has demonstrated to generate less greenhouse gas (GHG) emissions on combustion than other hydrocarbons, emitting almost 30 percent less carbon dioxide when burned than oil, and just less than 45 percent carbon dioxide compared to coal.¹

This attribute makes natural gas a desirable commodity for many of the 37 industrialized countries of the EC, where emission reduction is a political goal. The EC has agreed to reducing GHG emissions under the Kyoto Protocol, the international agreement linked to the United Nations Framework Convention on Climate Change. No one questions that the demand for natural gas is increasing as one of the cleaner forms of energy needed worldwide.

As well, the U.S. has put green targets on the agenda in a way that it has not done before. The country is set to pledge a 17 percent cut in GHG emissions from 2005 levels by 2020.²

1. Source: <http://www.naturalgas.org/>, sister website of the Natural Gas Supply Association

2. Source: <http://news.bbc.co.uk/2/hi/europe/7765094.stm>

A new business approach

Operating in this more competitive and high-demand environment requires new solutions to maintain efficient and effective business in the natural gas market. As large industrial companies increasingly buy natural gas from different sources—or even just differentiate their different gas value-chain businesses as separate companies under the same holding—there is more need for fiscal or custody transfer measurement. As the natural gas marketing opportunities and possibilities increase, an accurate control of the gas traded and delivered becomes vital.

It is clear that standard business processes must evolve to yield new best practices supporting efficient and secure natural gas transactions and allow competitive success.

Gas measurement adds value for the enterprise

One of the practical, real-time transactional processes gaining value in the natural gas industry is comprehensive gas measurement and analysis. This process includes validation of gas pipeline measurements through configurable rules to confirm data integrity prior to forwarding the data to other modules for further processing. Validation assures the accuracy of volumetric data such as flow rates, the primary physical measurements used in calculating flow, gas composition, and thermodynamic properties calculated from composition and the physical conditions in the gas infrastructure.

Validation can include simple limit checking to ensure certain variables are within expected levels and meet the values nominated in gas contracts. Validation of flow rate, flowing gas pressure and temperature are made based on the gas infrastructure operations and ambient conditions. Figure 1 shows how the validation tool of gas measurement software identifies a range of time during which operationally unreasonable measurements were recorded.

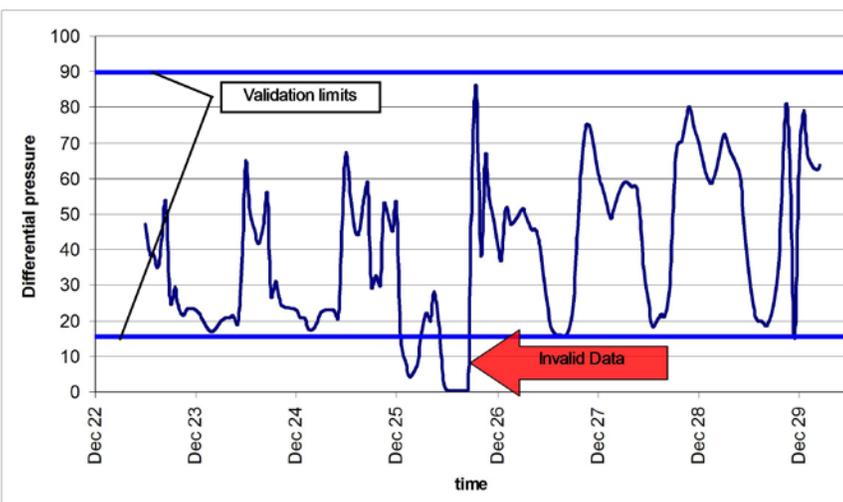


Figure 1
Real-time gas measurement validation from Schneider Electric GMAS
 Automatic validation module of gas measurement applies user-configured limits to pipeline differential pressure and identifies measurements that can be flagged as either suspect or invalid, helping gas analysts prioritize potential problems.

Data validation improves financials

Incorrect primary data such as the values flagged in Figure 1 will yield an incorrect gas volume and energy calculation. Detecting an invalid measurement (flow rate, pressure, or temperature) through validation allows data to be edited and corrected, with complete documentation, to assure accurate calculations of energy content for billing and transactional balancing.

Without such validation, financials on the related delivery and marketing action are directly, and adversely, affected. Table 1 illustrates, using data from a European gas transmission company, the cost of an undetected and uncorrected calorific value or delivery measurement. The company's annual throughput is 95 million cubic meters of natural gas with an energy content of approximately 37 megajoules per cubic meter.

Data scenario	Volume billion SCM	Calorific value MJ/SCM	Energy content PJoule	Value of Gas Million €	Cost of error Million €
True values	95,0	37,0	3,52	31.635	0
Calorific value is 0,5 percent low	95,0	36,8	3,50	31.476	158
Measured delivery is 0.05 percent low	95,0	37,0	3,51	31.619	15

*At the time of this data collection, the price of natural gas in Europe was about 10 euro per gigajoule.

Table 1
Example of how non-accurate measurement or invalid data influences financials

The validation engine of a gas measurement system can also draw on operational business data, such as the nominated receipt and delivery amounts available from gas contract or gas market management systems. This interaction enables validation that not only reflects accurate measured data but also verifies that measurements are correct from the perspective of the expected business transaction. Figure 2 (next page) illustrates the entire business process and shows how a gas measurement system supports accurate financials.

Gas composition key in financials and environmental impact

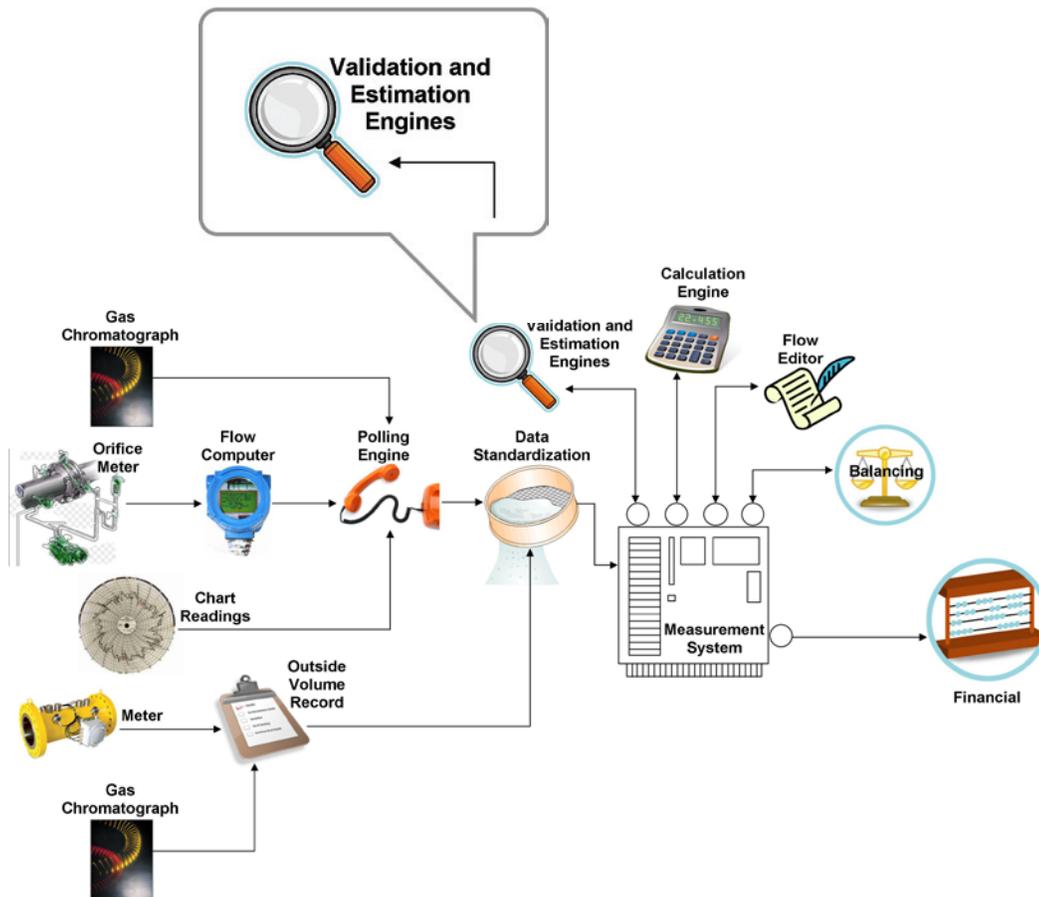


Figure 2
A gas measurement and analysis application adds value to the enterprise's flow measurements by monitoring them continuously; applying validation, estimation, balancing, and editing; and making them available in real time to accounting and other enterprise processes.

Because gas composition is necessary to convert raw volumetric flow to energy flow, gas composition and derived gas quality metrics become as important as validation in supporting accurate financials.

Typical gas composition analysis yields percentage of common hydrocarbons (methane, ethane, butane, and propane) and inert gases (nitrogen, carbon dioxide); from which heating value, specific gravity and density are identified; see Figure 3 (next page). More detailed analysis could include additional hydrocarbon components, plus diluents such as hydrogen, helium, oxygen, carbon monoxide, and hydrogen sulfide. Validating the analyzed gas composition records coming into the system against expected composition of gas assures accurate energy content calculation for billing and transactional balancing.

Risks and implications without gas measurement

- **Loss in profitability.** When billions of cubic meters of natural gas flow through transcontinental transmission pipelines, the value of the pipeline volume is millions of dollars. Accurate gas flow readings at custody transfer points are vital; without them, lost or unaccounted-for gas directly affects the bottom line.
- **Negative impact on environment.** Not having real-time gas composition determination would hamper efforts to identify trends in GHG emissions.
- **Negative impact on decision making.** Inaccurate measurements that reflect an erroneous economic situation can lead to decisions adversely impacting the company's bottom line.

Best practices put gas measurement to work

- **Knowing what passes through the gas infrastructure.** Consolidated accurate measurement is the basis of business in every natural gas delivery industry, because measurement is the precursor to accounting and the generation and checking of invoices. Yet, collecting gas volume measurements assumed to be accurate is just the beginning of the quantification process.
- **Validation with transparency.** Because measurement data are directly related to accurate energy content calculation and billing, they should be subject to the same control processes as financial data. These controls specify which data undergo what tests, how they are to be adjusted, who can perform edits, and how such actions must be documented.
- **Forecasting and estimation of missed data.** It is not surprising when field equipment exposed to harsh and widely varying conditions fails. Data also might be late or missing when it comes from less reliable or timely sources. The ability to automatically and accurately estimate and replace missed data supports timely accounting close and system balance. Estimation also helps predict future measurement parameters, allowing analysts or operators to better prepare for the upcoming schedule.

Best practices put gas measurement to work (continued)

- **Control of post-closing adjustments.** The measurement system contains the information and the log for problematic data requiring adjustment to a closed accounting period and possible re-invoicing.
- **Determination of GHG.** With the composition data made possible by gas measurement, GHG emissions data can be determined and compared from one year to another, forming the basis for reduction action plans.

Conclusion

GMAS in a nutshell:

- A complete and accurate gas measurement and analysis system adds value to the natural gas enterprise's volumetric measurements by monitoring them continuously and by combining them with demand, environmental, physical, and chemical data for relevancy.
- It makes these value-added data ready in real time to all appropriate persons across the enterprise for judicious decision making.
- Such enhanced functionality improves not only productivity, efficiency, and corporate governance but also helps optimize customer service, maintain competitiveness, and sustain the environment.

Measure. Analyze. Succeed.

Schneider Electric USA

10333 Southport Rd SW, Suite 200
Calgary, AB T2W3X6
Phone: 1-866-338-7586
Fax: 1-403-259-2926
<http://www.schneider-electric.com>