

ECONOMICS OF ELECTRONIC GAS MEASUREMENT

2004

Tom R. Cheney
Anadarko Petroleum
1201 Lake Robbins Drive.
The Woodlands, TX 77380

INTRODUCTION:

The fast pace changes in technology continue to keep us in a state of flux. There isn't any one who isn't impacted by the continuous growth and changes in the world of technology. In today's world, we accept computers and the functions they perform without question. In fact, we place our hard-earned dollars and in many cases our very lives in their care and control without a second thought. Computers and electronic technologies have greatly impacted the way work is done in the oil and gas industry. A good example of how these changes have impacted this business is the use of electronic gas measurement devices often called (EFM's).

With the use of the EFM, and associated electronic equipment, we not only have the option to measure gas volumes but to retrieve required data instantly and enhance production through well automation.

As in any business, before the decision is made to upgrade or change from the standard method of measurement using the typical dry flow chart recorder to EFM, the economics of such a decision needs to be evaluated.

It is becoming common practice to install EFM on all new measurement stations. The real battle over economic justification seems to be in the decision to replace meter stations, which already have chart recorders in place with EFM's. You will find that the economic justification of using EFM is often difficult to quantify.

SCOPE:

Over the last few years of sitting in many hours of meetings trying to justify the conversion to EFM and automation, I have concluded that there is not an off-the-shelf equation for determining this economic justification. I feel there are five primary areas that must be considered when making this evaluation. This paper will focus on these main elements. These elements are (A) Field operations and efficiencies, (B) Measurement accuracy, (C) Initial costs of installation, (D) Future growth or expansion, and (E) Standardization.

BACKGROUND:

When we finally made the jump from mercury meters to dry flow chart recorders, we were impressed with how far technology had taken us. It didn't take long until we were introduced to the first electronic meter that not only took the place of the dry flow meter, but would also replace the chart and the need for chart integration.

When the EFM's first hit the market, many were purchased and installed for the sake of testing technology, rather than used for the proclaimed improvements they brought to the table.

In time, the flaws of the electronic world surfaced -- such things as lack of enough battery power, too small of computer memory, lost data, incorrect calculations, and the lack of field personnel with the technical knowledge to service the new devices, to name a few. The first reaction was, "electronic equipment doesn't work." Manufacturers went to work and soon came up with new developments and improvements resulting mostly from complaints of their users.

The current generation of EFM and the end devices have made great improvements and are now widely accepted by the industry as the meter of choice. This popularity is due to the improvement in their electronics, improved accuracy, ease of use, as well as the capability to link with automation and instant data transmission.

Costs have come down; reliability has improved and the growing use of wellhead automation is on the rise. These combined elements, along with the acceptance of EFM by the American Petroleum Institute (API 21.1), have taken this technology from a choice by the users for the sake of testing new technology to a choice based on good business sense.

FIELD OPERATIONS AND EFFICIENCIES:

In the last few years, we have seen a movement in our business to have the field operator become the jack of all trades. In many cases, this transition has included measurement duties and tasks. Let's explore the pros and cons as to how EFM has played into these decisions.

When the field operator arrives at the production location or measurement site, generally their task list is pretty large. Not only do we expect more of them while on each location; they are also asked to visit more locations each day.

Charts are generally changed every seven to eight days. On these chart days, the operator will normally zero the meter and replace the chart. Past experience has indicated that if the field operator is running behind, performing the zeroing process is often put off until the next visit or chart day. The chart that was changed is then edited or reviewed for problems prior to being sent to the chart integrator. If a recording problem is present, then it must be corrected before the operator can leave the location. Whenever the recording pens are changed, this creates a need to check and adjust any incorrect pen tension, time lag or pen-arch problems. Depending on conditions, this work can be a time consuming task.

Of course, this is the problem of having a chart recorder. However, before we move on to the pros of having an EFM at these locations, keep this one point in mind. One of the perceived advantages to having a chart recorder is the quick ability to look at a week's worth of data at just one glance. This information can be a quick reference for troubleshooting a problem or understanding the flow patterns of a particular well. With EFM, this data is still available, however, requires a series of additional steps to view the data while on location. This step typically is done once a month when the data is collected. What we really have is a shift in a paradigm that has existed for many years.

If all is working right, the EFM does offer the field operator savings of time. With just a glance, flows and pressures can be obtained. With the presence of remote data transmission, this information can be collected daily and often eliminates the need for a visit to the location. This one option has proven to play a big role in making the economic decision about electronics being used at many locations.

When making the decision about installing EFM, take into account the following items:

- EFM allows you to store up to thirty-five days or longer, of data. This can eliminate the need to visit the location at least every chart period, which typically is every seven to eight days.
- If you tie radio telemetry to the EFM, you can retrieve the data at any time.
- If you tie in automation equipment, you can operate the location from a remote location.
- The cost of an EFM is still more expensive than a dry flow chart recorder but is coming down in price and has proven to be very reliable.

With all this information taken into account, it appears that with careful planning and the proper equipment, you can reduce manpower and the vehicle costs associated

with traveling to each location. These savings may be redistributed to other important activities.

The need to keep technical expertise or training up to speed is even more important with EFM than it was with dry flow chart recorders. If a technician does not perform the procedures correctly or understand the fundamentals of what makes this complex system work together, many dollars can be lost without someone even recognizing the errors. Each method requires different knowledge and skills.

MEASUREMENT ACCURACIES:

Let's face it; accuracy is only as good as the equipment and the technician who maintains the equipment. The equipment in today's market is top of the line. It is common to see EFM manufacturers advertise very precise accuracy. If all the other variables are maintained properly, such as orifice plates, meter tubes, samples and chromatographs, this improvement is a favorable one.

Whether you have chart recorders or EFM, the need for accuracy remains the same. The advantage that EFM has to offer is the ability to take readings every second if required. If no future editing or recalculation is required, the data can be downloaded directly into a data base system. This process eliminates the need for someone to interpret the data that has already been captured on a chart.

Wells with flowing characteristics that cause a wide range of flow volumes can be a problem for a chart recorder and integrator. It is difficult to determine flow volumes when a chart is wiping a line from 0 to 100% of the chart range every few minutes or even more often. Also, it is difficult to determine accurate volumes when the well is producing and recording very low readings on the chart. Not only can it be difficult for the field operator to determine a flow volume; it can be even more difficult for the chart integrator to interpret where to trace the flow pattern.

With all things taken into consideration, the EFM eliminates some of the opportunity for the introduction of human error.

Many companies have become so confident in these numbers generated from the field locations that direct billing is often implemented as this data is received.

As mentioned in the previous section, many people hate to see the chart recorders go away because of the information they offer a field operator at a glance. On the other hand, speed, accuracy, and the savings of manpower costs, which the EFM offers is a big plus in making the decision of which method to choose.

INITIAL COSTS OF INSTALLATION:

If you are installing the basic measurement elements for data capture or volume calculations, you will find the initial cost for an EFM and Chart Recorder to be about the same.

A chart recorder will cost you +/- \$1500.00, while an EFM with no additional I/O capabilities can be purchased for +/- \$3000.00

First glance of these numbers would lead you to believe that there is no advantage to selecting EFM's over a Chart Recorder. Depending on your company's overall goals and plans, this situation may be the case. The next section will lead you into some thoughts that should be explored prior to making this decision.

FUTURE GROWTH OR EXPANSION:

You should take a hard look at what your company strategies are when it comes to future operations. Additional money can be needlessly spent without proper planning. There has been stand-alone EFM purchased for a location. Later it was decided to install communications at the location in order to obtain the flow data daily. The EFM had to be upgraded along with the installation of the communication equipment. At a later date, the decision to automate the location was made; and again another EFM with a larger memory and lower power demands was installed. Good intentions were in place; however, the total cost of the project turned out to be much higher than it needed to be if proper planning had taken place.

Sometimes purchasing equipment that can easily be expanded with minor changes may be the best and most economical choice if the possibility of expansion is a reality.

There are several additional functions that may be added to the location, all of which should be considered when making the EFM hardware selection. Some of these functions may include the following:

- Flow Control (Maintaining flow within the range of the meter.)
- Plunger Lift Control
- Production Optimization
- Driving a Sampler
- Valve Switching
- Leak Detection
- Emergency Shut-Downs (ESD)
- Liquid Metering
- Wellhead Monitoring
- Downhole monitoring
- Compressor Control and Monitoring
- Pump Control
- Gas Quality monitoring
- Chromatography

- Live Data to several sources at one time
- Web applications

If expansion is a possibility, the original set up should also include considerations for the following:

- Communication Requirements
- Power Requirements
- Host PC Selection
- Technical Support

There is nothing that a good manager or field operator hates to hear more than, "Why didn't we think of that before?" If you are making the change to EFM, you might want to consider spending the extra money up front if growth or expansion is possible in the future. In the long run, the cost may be lower.

STANDARDIZATION:

Many companies have several different brands of EFM at their locations. This may have been a decision based on avoiding the trap of having all your eggs in one basket. The down side to this scenario is the additional inventory of parts and technical expertise that is required to maintain different brands of equipment.

One economical consideration is standardizing one brand or system to be used throughout your company. This step can simplify training, manpower utilization, parts inventory and troubleshooting problems. Also, this process could give you an edge for obtaining a good price on the equipment because of the volume of equipment you control. Standardization also gives you some leverage with the manufacturer in regards to changes or improvements that you would like to see made to the equipment or software.

CONCLUSION:

Economic justification of EFM is not black and white. In many cases, the dry flow chart recorder may be the most economical choice. On the other hand, increasing demands for instant reliable numbers, manpower utilization, well optimization, and remote control or automation of our equipment are all now a reality. It is now common to find most large gas transmission companies using EFM equipment. The focus is slowly turning away from the decision between dry flow meters and EFM and is focussing on what additional EFM upgrades are needed to meet the future needs.

Usually there is no economical or single justification for making the change. It often boils down to where you want to be in the years to come.

This paper has attempted to point out the need to look beyond your immediate needs and look into your future needs when making this decision.

REFERENCES:

“Fluid Flow Measurement” E.L. Upp

“Economics of Electronic Measurement”
Harry J. Workmon, GPM Gas Services Company
1997 Proceedings ASGMT

“Economics of Electronic Measurement”
Class 172
Ben Wagner, Strategic Controls Corporation