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**Skills
WORKSHOP**

Developing a
gas measurement
and monitoring
plan – Part 2

FEATURE

Ammonia
glycol chiller



PACIFIC PERSPECTIVE

**THE AUSSIE HVAC&R TRAINER SCHOOLING
THE PACIFIC ISLANDS' FUTURE TECHS**

DEVELOPING A GAS MEASUREMENT AND MONITORING PLAN

Gas is an important energy source and significant cost for many organisations throughout Australia. The diversity of uses and equipment involved can make gas consumption difficult and expensive to measure and monitor. However, by having a clear set of goals and understanding gas use, you can develop a targeted and cost-effective plan to manage it.

In part two of this series, Skills Workshop will continue to delve into the methodologies to prepare and implement a gas measurement and monitoring plan.

PULLOUT

DEVELOPING A GAS MEASUREMENT AND MONITORING PLAN

Step 4

Specify and select suitable meters and their communication system

Specify meter requirements

As a minimum, consider the following three aspects when formulating specifications for any new permanent meter:

■ Purpose of the new meter:

- What parameter will be measured (flow, temperature, gas composition, pressure)?
- How will data from the flowmeter be used – for process control, safety checks, billing purposes or as a source of basic information (this indicates what accuracy and repeatability may be required of the meter)?

■ Environment in which the new meter will be placed:

- Where will it be located (e.g. base of building, indoor/outdoor, chemical use area)?
- What size and type of pipe will be required (if a flowmeter)?
- What are the characteristics of the fluid to be measured:

- nature of the fluid: liquid, gaseous or a mixture
- flow, temperature, pressure range (depending on which parameter is to be measured)
- other characteristics such as cleanliness of the fluid, potential for corrosion and conductivity?

■ Communication system which will be associated with the new meter:

- Will the meter be connected to the existing SCADA system?
- If yes, what is the preferred communication technology (e.g. Wi-Fi, ethernet cable)?

As part of your gas measurement and monitoring plan, identify the existing meters that would benefit from verification, calibration or replacement, or that could be removed.

Suppliers are a good source of guidance on questions to ask during the specification stage.

Select the meters

The selection of the most suitable metering devices can be an iterative process with the different suppliers. Selection decisions should be based on:

- the technologies available for your application
- your specification
- ease of installation and maintenance
- life-cycle costs
- budget allowance.

If the meters are going to come into contact with hazardous fluids or will be installed in a hazardous area, request confirmation from the supplier that the meters meet these requirements.

Measuring flow and converting to energy

Unlike measuring temperature and pressure, measuring the flow of a fluid is more technically complex and costly, and therefore is less common. However, it is essential for monitoring energy use.

In many thermal applications, measuring total energy supply to a process or area requires several pieces of data: typically flow (kg/s), supply temperature, return/outlet temperature pressure, and the specific heat capacity of the fluid (kJ/kg.K). Each situation is unique and it is difficult to generalise, so engineers should be consulted on the specific process conditions that should be monitored to evaluate energy flows.

Converting utility gas flowmeter data to energy is relatively straightforward if you have volume data corrected for temperatures and pressures. The gas volume can be multiplied by an industry average calorific value to equate to energy in GJ. A more accurate calculation would be to multiply the corrected gas volumes by the calorific values published specifically for your part of the gas network. Section 2.3 (See HVAC&R Nation, August 2016) explains how to directly connect to your gas utility meter.

The important message here is that if you get the right process data, the energy flow calculation can be completed in the PLC, SCADA or BMS system.

Step 5

Develop a budget and implementation plan

Budget considerations

Consider all aspects of meter installation and how the data will be captured and used. Table 2 summarises associated areas of cost beyond the cost of the meters themselves.

Implementation plan

The implementation plan must take into account:

- **Procedures** – What procedures need to be followed in this installation? Are all subcontractors inducted and permitted on the site?
- **Schedule** – Can the meters be installed during a weekend, in a way that minimises disruption to production or office activities? Will this incur penalty rates for installers?
- **Commissioning** – Are new control settings required? How long will commissioning take?
- **Communication** – Will there be disruptions to services? Who needs to know?
- **Fine-tuning and validation** – After the initial commissioning, how will results be tested to ensure they are realistic?
- **Reporting and alerts** – What procedures will be put in place for energy monitoring, responses to alerts and reporting?
- **Safety** – How will the installation be completed safely?
- **Training** – Which personnel will be trained in the operation and maintenance of the new meters and data management system?

Mapping out all the tasks required in the project, and understanding the links between them (e.g. installation can only occur after the parts have been delivered) helps to develop a realistic schedule. A Gantt chart is one way to visualise how tasks link together and probable timeframes for final delivery of the project.

For industrial applications, the single biggest impact on the delivery schedule is likely to be the need to organise an installation of flowmeters around production.

Setting responsibilities and procedures

Management and responsibility assignments must be developed alongside metering to realise the full potential of data analysis and energy monitoring.

Too often industries implement good metering and data collection but nobody is made responsible for monitoring the data and taking action if required.

Thinking about safety

Be aware of any safety requirements related to the installation of meters and associated instrumentation. Intrinsically safe electrical designs are required for electrical equipment in areas around utility gas meters.

Table 2: Budget considerations for a meter installation

Costs	Description
Installation considerations	<ul style="list-style-type: none"> • Purchase of the meters and associated equipment • Work needed to physically install the meter and its associated components into the system, e.g. additional flanges, modification to pipework, power supply for the meter, hazardous area protection • Disruptions to production and planning related to the meter installation • Integration to data-recording systems (data cabling, computers, software licences) • Costs related to its later removal, if the meter is installed on a temporary basis
Maintenance and recalibration during the life of the meters	<ul style="list-style-type: none"> • Maintenance (cleaning, replacement of components or sensors) • Verification and possible recalibration
Data collection and storage	<ul style="list-style-type: none"> • The preferred data acquisition system – existing or new • Storing the data • Making data available for different analysis or reporting systems
Data analysis and reporting	<ul style="list-style-type: none"> • Procedures and systems to interpret and use the data acquired from the gas measurement and monitoring program
Training	<ul style="list-style-type: none"> • Training is often marginalised, under-funded or, at worst, forgotten. Unless operational managers and plant staff receive adequate training on new techniques and equipment, the data won't be used and many of the projected savings will not be realised

When installing flowmeters and associated electrical equipment in your plant or building think about:

- explosive zones – the installation of, and connection to flowmeters in some industrial plants could require design and installation of intrinsically safe equipment
- use of personal protective equipment (PPE)
- working at heights
- presence of chemicals
- fire and explosion risks
- working in confined spaces
- equipment isolation procedures
- approvals
- electrical safety.

SafeWork NSW10 has a wide range of tools and resources to help small and large businesses manage work health and safety.

WHAT TO DO NEXT

Write a gas measurement and monitoring plan

The task of gas measurement, monitoring and analysis is never finished. Think of it as a journey rather than a destination. There are always other things that could be metered, additional data to analyse or maintenance to be done.

This guide (Part one and Part two) has provided five steps to help you get started on writing your gas measurement and monitoring plan. Using this guide will be the first step to start the journey.

Write a business case

Having a sound gas measurement and monitoring plan is no guarantee that it will be implemented. One of the most challenging steps is to convince others of the need for change. An effectively written business case is a vital part of the process. If you have worked through this guide, you should have all the information you need to write an effective business case that sets out the costs, benefits and risks of a gas measurement and monitoring program.

You can use your organisation's business case format. The gas measurement and monitoring plan can be included as an attachment.

When preparing the internal business case think about:

- who in the organisation is going to approve the gas measurement and monitoring plan (stakeholders)
- who will benefit from its implementation (allies)
- what reporting will be required (exception-based or continuous alarming when parameters drift out of pre-set boundaries) and who will have responsibility for monitoring
- who will take action if energy use is higher than expected
- whether your gas measurement and monitoring plan is sufficiently robust and is based on evidence from your initial investigations.

BENEFITS OF GAS MEASUREMENT AND MONITORING

Gas measurement and monitoring brings a range of benefits for site personnel.

Potential benefits	Management and finance	Operations and maintenance
Supports decision-making and budgeting processes <ul style="list-style-type: none"> Data highlights variations in energy use and provides guidance on remedial action. Data can be used to set energy cost budgets. 	✓	
Allocates energy costs to cost-centres <ul style="list-style-type: none"> Knowing energy consumed by different end-users allows better allocation of costs (e.g. to tenants or departments in a commercial building, or product types in a factory). 	✓	
Helps to optimise gas consumption based on your tariffs <ul style="list-style-type: none"> When you understand gas tariffs and how gas is used on your site, costs may be managed by shifting some gas usage to periods with cheaper tariffs or smoothing out energy demand to make it more consistent throughout the day. 	✓	✓
Helps to prioritise opportunities and control energy use <ul style="list-style-type: none"> Knowing how gas is used on your site helps to identify your main gas energy consumers and to prioritise actions to control energy consumption and carbon emissions. 	✓	✓
Tracks performance against energy performance targets <ul style="list-style-type: none"> KPIs can be developed at a granular level across a site, making possible the tracking of energy performance over time. 	✓	✓
Provides better control of processes and systems <ul style="list-style-type: none"> Accurate metering of energy flows can improve control of many industrial processes or building systems. 		✓
Detects poor performance early <ul style="list-style-type: none"> Metering can help identify faults quickly, such as equipment left operating unnecessarily, or processes that are operating outside of the normal range. Long-term monitoring identifies slow increases in energy consumption, such as those related to leaks, and speeds up repair processes. It also helps with maintenance planning. Operators or maintenance personnel can use alerts via email or SMS to take immediate action when energy consumption exceeds pre-set thresholds. 		✓
Measures performance of new equipment and processes <ul style="list-style-type: none"> Good data allows the comparison between actual performance of an upgrade project with the forecast performance. 	✓	✓
Improves reporting for government programs <ul style="list-style-type: none"> Government programs designed to reduce carbon emissions or support the implementation of energy conservation measures increasingly require project reporting based on measurement and verification of energy savings. Gas measurement and monitoring provides the data necessary for these reports. 	✓	
Promotes competitive advantage <ul style="list-style-type: none"> Your site operates in a competitive environment where profit margins are under pressure. Gas measurement and monitoring allows for fine-tuning and maintaining tight cost control in operations, leading to sustained competitive advantage. 	✓	✓

To motivate people to change, consider making your case by:

- creating dissatisfaction with the current situation by quantifying the potential energy waste in \$/annum, or total cumulative cost over the next five to 10 years
- creating vision by setting goals and potential benefits that are easy to visualise and quantify – a gas measurement and monitoring plan is a long-term project with short-term and long-term benefits, and stakeholders will have different views on their importance
- articulating the steps to achieve what you want.

Contact OEH

The NSW Office of Environment and Heritage provides support through periodic funding programs, and pre-qualified contractors to assist in the implementation of gas measuring and monitoring systems.

For more information, please contact the Markets and Finance team on 1300 361 967. ■

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MORE INFORMATION

This month's Skills Workshop was adapted from the NSW Office of Environment and Heritage's Gas Measurement and Monitoring Guide.



For more information, visit www.environment.nsw.gov.au

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