AVTRON
POWER SOLUTIONS

Best Practices for Managing Associated Gas Flaring Using Load Bank-Enabled Power Generation

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Best Practices for Managing Associated Gas Flaring Using Load Bank-Enabled Power Generation

Associated gas is an unavoidable byproduct of oil production and often does not meet pipeline-quality specifications due to heavier hydrocarbons, contaminants, and variable composition. When processing or export infrastructure is unavailable, operators may flare this gas to maintain safe operations, resulting in lost energy potential and operational inefficiencies.

This white paper presents a best-practice approach for integrating Avtron resistive load banks with associated-gas-fueled power generation systems to improve generator stability and increase gas utilization. By providing controlled, scalable electrical loading, load banks help maintain generators within target operating ranges during variable site demand.

The result is more consistent operation, improved commissioning repeatability, and the ability to convert a greater portion of associated gas into productive electricity—supporting reliable operations across both onshore and offshore facilities while helping reduce routine flaring where power generation is used.

Understanding Associated Gas and Flaring Challenges

What is Associated Gas?

Associated gas is produced alongside crude oil and typically differs from pipeline-quality natural gas:

- Methane concentration lower than pipeline specifications (~99%)
- Presence of heavier hydrocarbons
- Variable contaminants and moisture

Because of these characteristics, associated gas often requires significant processing and cleanup before it can be injected into natural gas pipelines.

Why Flaring is Still Widely Used

When processing or export infrastructure is unavailable or uneconomical, operators flare associated gas to:

- Maintain well and process safety
- Control pressure in production systems
- Reliably dispose of off-spec gas

While flaring reduces methane's greenhouse impact by converting it to CO_2, it also represents lost energy potential and operational inefficiency as flaring does not necessarily convert 100% of methane into carbon dioxide.

Regulatory Note (U.S.)
U.S. EPA methane regulations for oil and gas operations under the Clean Air Act remain in effect, with implementation timelines managed through state programs. Recent legislative and regulatory actions have adjusted certain compliance deadlines, and the previously proposed federal waste emissions charge is not currently in effect.

As a result, operators continue to prioritize operational solutions that improve gas utilization, enhance combustion stability, and reduce routine flaring while maintaining reliable production.

Associated Gas Utilization via Power Generation

Gas-Fueled Generators as an Alternative to Continuous Flaring

Many oil and gas facilities deploy gas-fueled generators to consume associated gas locally, producing electrical power for:

- Production equipment
- Pumps and compressors
- Platform utilities
- Remote or islanded operations

However, generator systems require stable electrical loading to operate efficiently and maintain proper combustion.

The Operational Problem: Insufficient or Variable Load

In practice, power generation systems face several challenges:

- Facility electrical loads fluctuate with production and process conditions
- Minimum loading thresholds are not always met
- Excess associated gas remains unconsumed
- Power generation systems may operate inefficiently, experience instability, or trip offline

As a result, flaring often continues—even when gas-fired power generation capacity is available.

Customer challenges (Associated gas + power generation reality)

Operators commonly face the following challenges when attempting to utilize associated gas through power generation:

- Variable gas composition and flow, leading to unstable generator operation and reduced efficiency.
- Minimum loading requirements, creating risk of incomplete combustion, combustion instability, or wet stacking in certain generator configurations.
- Remote and offshore constraints, limiting the ability to dynamically balance electrical load.
- Commissioning and maintenance complexity, driving the need for repeatable, auditable testing.
- Pressure to reduce flaring without disrupting production or reliability.

Load Banks as a Best Practice Solution

In facilities where associated gas is utilized for on-site power generation, maintaining generators within their optimal loading range enables greater gas utilization and can help reduce routine flaring during low-demand conditions.

Role of Load Banks in Associated Gas Applications

Electrical load banks provide controlled, supplemental electrical demand, allowing generators to:

- Operate at optimal load levels
- Maintain stable combustion

- Consume a higher percentage of associated gas
- Reduce reliance on continuous flaring

By absorbing excess electrical capacity, load banks effectively convert surplus gas into useful thermal dissipation via electrical load, enabling consistent generator operation.

Benefits of Load Bank Integration

Best-practice outcomes include:

- Improved generator efficiency and reliability
- Increased associated gas utilization
- Reduced flaring events during low facility demand
- More stable generator operation during variable or low-demand conditions.
- Improved operational flexibility in remote or offshore environments

Load banks do not replace gas treatment systems but complement them by stabilizing generator performance when gas quality and load demand varies. In situations where associated gas handling capacity limits production and gas-fired power generation are available, load banks can provide the supplemental electrical demand needed to increase on-site gas utilization.

The Avtron Solution Portfolio

Purpose-Built Load Banks for Onshore and Offshore Applications

Avtron load banks provide a flexible, scalable solution for absorbing supplemental electrical load, enabling generators to operate at optimal conditions while consuming associated gas.

Onshore Applications – e.g. Avtron Model 4800

- Low-voltage (LV) resistive load bank platform
- 450 kW to 3000 kW capacity range
- 208 V to 600 V operation
- Permanent outdoor installation with NEMA 3R enclosure
- Designed for continuous duty and harsh environments.

Offshore Applications – e.g. Avtron Model 8750

- Containerized (ISO 30ft) medium-voltage (MV) load bank platform
- Up to 5 MW capacity range
- Up to 33 kV operation
- Resistive loading capability
- Well suited for offshore platforms and high-capacity generation systems
- Optional stainless steel components and structures for longer term offshore applications

Key Benefits of the Avtron Approach

- Stabilizes generator operation under variable facility demand, improving reliability and uptime
- Increases utilization of associated gas through productive power generation
- Reduces flaring during low-load or transient operating conditions
- Scales easily as production or power requirements change

How it Works

Associated gas fuels one or more generator sets, producing electrical power. Figure 1 illustrates the operational flow from associated gas production to flaring reduction using Avtron load banks.

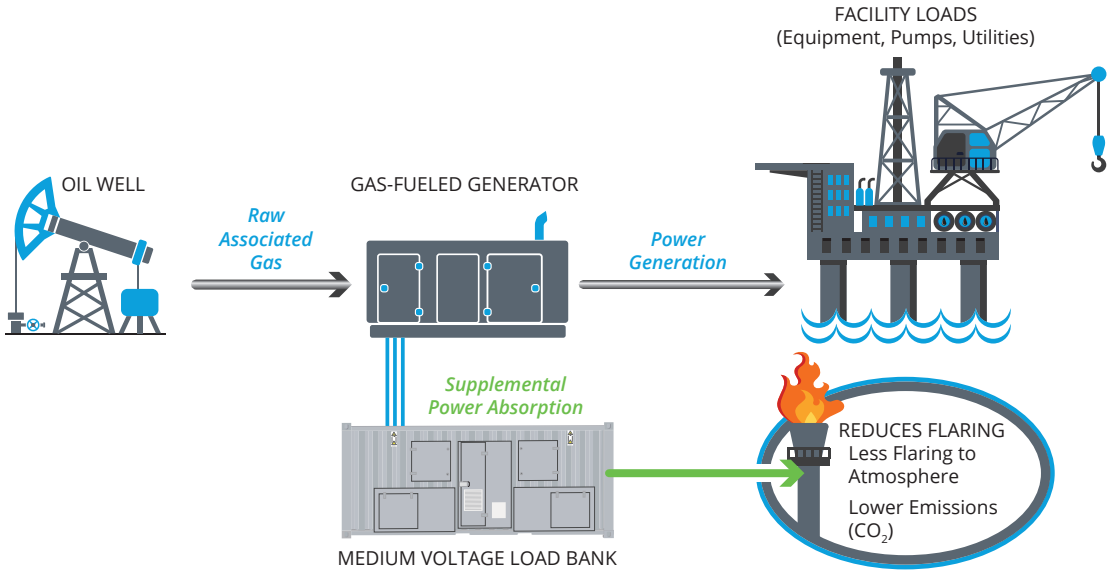

Figure 1. Operational Flow. Utilizing Associated Gas for Power Generation.

- Facility loads consume a portion of the generated power.
- When facility demand is insufficient or variable, Avtron load banks absorb supplemental load.
- Operator executes step loads / ramps and holds to:
  - stabilize genset operating point
  - validate performance
  - consume additional fuel (associated gas) through productive generation
- SIGMA 2 + SIGMA Unity provide centralized control + repeatable test execution + data capture.
- Alternatively, Avtron can offer site load corretion that automatically applies load when required.

Advantages of Using of Avtron Load Banks

- Outdoor-ready LV platform for permanent sites. Model 4800 is NEMA 3R and UL 508A listed.
- MV container options available. Model 8750 features an inbuilt load bank and MV transformer in a single 30ft ISO container.
- Networked control & scalability: SIGMA 2 supports networks “up to 42 units,” and SIGMA Unity can name/network/group load banks and automate tests with data capture and reporting.
- Integration flexibility: SIGMA Wireless Gateway can interface with Modbus TCP/IP environments via SIGMA Unity.

SIGMA 2 Controls and SIGMA Unity Software

Avtron load banks are equipped with SIGMA 2 digital controls and managed through SIGMA Unity software, providing:

- Centralized monitoring and control of individual or multiple load banks
- Automated load sequencing and test execution
- Comprehensive data logging and exportable reports

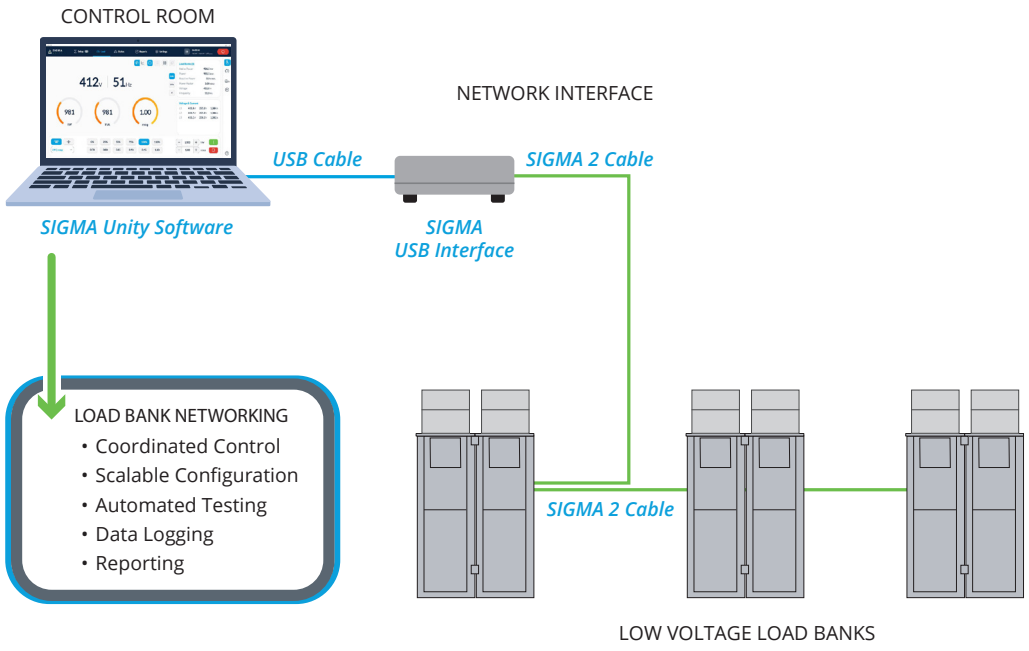

Figure 2. Operational Flow. Networked Load Bank Architecture.

Networked architecture for scalable operations

A networked architecture enables scalable deployment across complex facilities:

- Multiple 4800 and/or 8750 load banks can be controlled from a single interface.
- Load banks can be distributed across LV and MV buses
- Connect load banks via SIGMA 2 controls and operate through SIGMA Unity for centralized visibility and coordinated control.
- Wired or wireless communication options simplify integration
- Modbus TCP/IP connectivity supports integration with site control systems

This architecture allows operators to scale from a single load bank to a coordinated, multi-unit system as operational needs evolve.

Hybrid Commissioning and Operational Case Example

Avtron's hybrid-network article supports the concept of centralized control, coordinated sequences, and data logging across a mixed load bank fleet.

Application Scenario

- Offshore production platform with medium-voltage generation and localized low-voltage loads

Challenge:

- Facility load variability leads to low-load generator operation
- Excess associated gas remains unutilized, resulting in continued flaring

Deployment:

- Avtron 8750 load bank connected at the MV bus to provide bulk loading
- Avtron 4800 load bank deployed at LV distribution points for fine load control
- Centralized operation using SIGMA Unity software

Results:

- Improved generator stability during load swings
- Increased utilization of associated gas
- Repeatable, auditable commissioning and testing processes
- Faster setup and coordination across multiple load bank assets

This approach allowed operators to respond dynamically to load variability without modifying production processes.

Key Outcomes

- Enhanced generator reliability and efficiency
- Reduced flaring during low-load operating conditions
- Improved operational flexibility in remote and offshore environments
- Data-driven commissioning and maintenance workflows
- Scalable infrastructure aligned with future production changes

Best Practice Design Guidelines

When specifying load banks for associated gas applications, best practices include:

- Sizing for minimum generator loading, not peak facility demand
- Scalable or modular architectures to accommodate production changes
- Continuous-duty ratings for extended operation
- Automated control and integration with generator management systems
- Environmental protection is appropriate to offshore or desert conditions

Summary

While associated gas flaring remains a necessary operational practice in many oil & gas environments, it does not need to be the primary operating mode. Integrating Avtron load banks with gas-fueled power generation systems provide a proven, best-practice approach for stabilizing generators, maximizing associated gas utilization, and improving overall operational reliability.

By enabling controlled electrical loading, Avtron load banks help operators convert surplus associated gas into productive energy—supporting safer, more efficient, and more sustainable oil & gas operations onshore and offshore.

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