



Experience Industrial Innovation

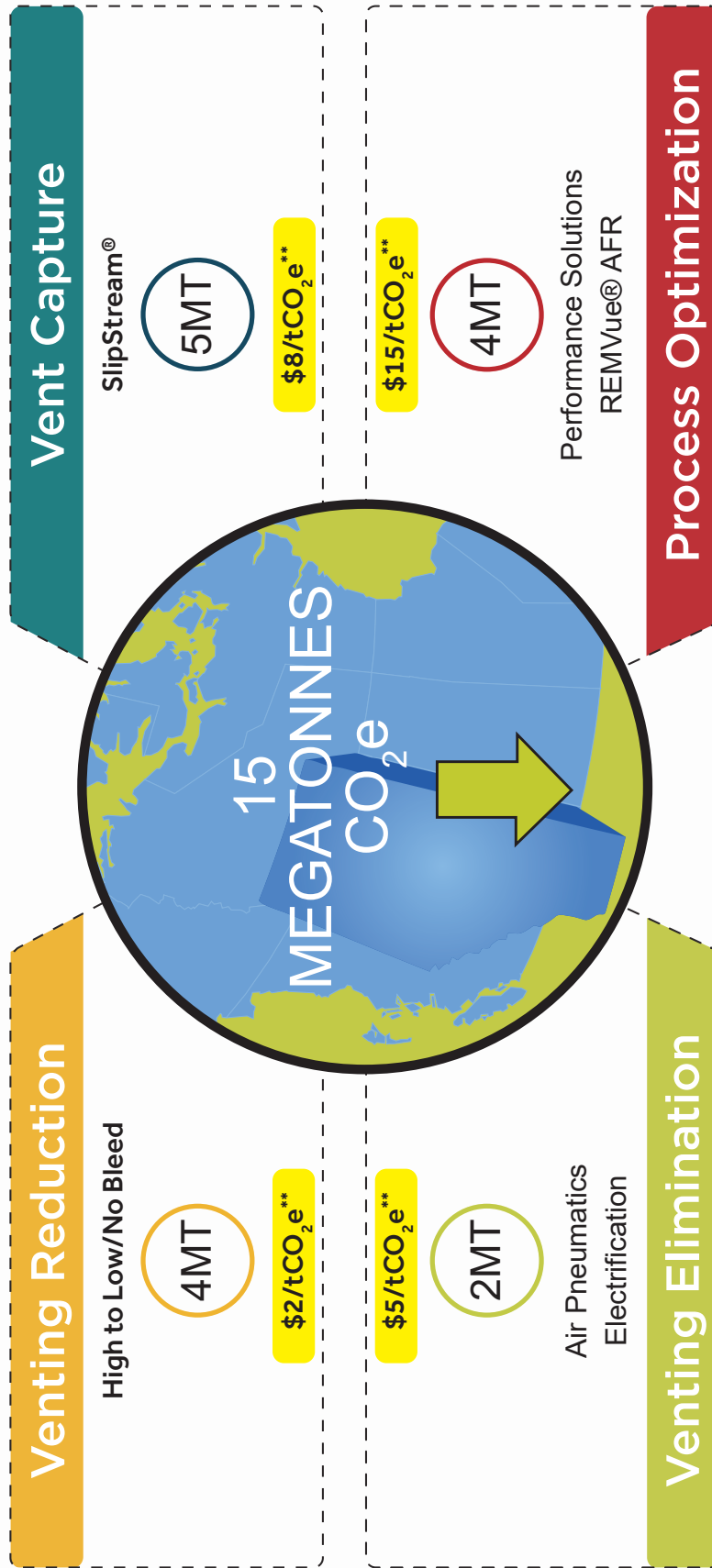


NON-VENTING UPSTREAM OIL & GAS SOLUTIONS

Leverage our clean and innovative solutions
for greenfield development

www.spartancontrols.com

Environmental Leadership GHG EMISSIONS REDUCTION POTENTIAL*



*Potential GHG reductions achievable with broad industry application of Spartan Controls' environmental technologies
**Abatement cost

Carbon offset protocols are available for the above technologies
Fuel gas, with the carbon offset value included, increases its total value from \$3/mcf to \$13/mcf (based on \$25/tCO₂e)

From the wellhead to the burner tip, our implementation-ready technologies listed below can be applied across the oil and gas spectrum.

Technology	Applicable Production, Process & Transmission Location			
	Wellhead	Compress/Pump Station	Midstream Pipelines	Condensate Tanks
Electric Valve Actuation	✓	✓	✓	
Electric Chemical Injection Pumps	✓		✓	
Self-contained Regulators	✓	✓	✓	✓
Instrument Air	✓	✓		✓
High Integrity Pressure Protection System (HIPPS)	✓	✓		✓
Thief Hatch	✓	✓		✓
Pressure Vacuum Relief Vent (PVRV)	✓	✓		✓
Vent Gas Capture - SlipStream®	✓	✓		✓
Variable Frequency Drives	✓	✓		
Enviro-SEAL™ Packing	✓	✓	✓	✓
Open Path Gas Detection	✓	✓		✓

Electric Valve Actuation

Ensure Energy for Failsafe Positioning

Electro-Hydraulic Actuator Technology

To create stored energy for failsafe positioning, hydraulic fluid pressure energizes gas-charged accumulators or compresses the actuator spring.

This is a self-contained system with built-in reservoir, control electronics and actuator.



Electric Fail-Safe Actuator Technology

This technology offers:

- Batteries, super-capacitors, and stored energy in accumulator
- Pure electro-mechanical failsafe functionality (spring)
- Guarantee that valve safety positions are achieved in the event of power failures

Electric Chemical Injection Pump

Inject methanol, corrosion inhibitor, dewaxer or other chemicals to promote reliable production.

LCO CROSSFIRE Pumps

- Perform the duty of up to four conventional pneumatic chemical injection pumps
- Provide continuous true proportion to flow delivery (demand based) and optimizes chemical usage, which reduces operating costs



Self-contained Regulator

Regulate Pressure Control

Pressure control can be achieved using devices that sense either downstream or upstream pressure and open or close proportionately to ensure that pressure remains near setpoint. This is a non-venting technology that has been used primarily in downstream natural gas distribution and can also be applied to upstream hydrocarbon production.



Instrument Air

Maintain Reliability and Eliminate Emissions

Conventional control loops in upstream oil and gas have used fuel gas pneumatics. This form of motive power can be replaced by instrument air, which maintains the reliability of assets that have been fit-for-purpose for decades. Instrument air eliminates the methane and volatile organic compounds (VOCs) that would otherwise have been vented. Power supplied from hydro has a much lower carbon footprint than other forms of non-renewable power generation.



High Integrity Pressure Protection System (HIPPS)

Prevent Overpressurization

HIPPS reduces flare loading, environmental impact pressure venting and the size and cost of the flare system. In new plants, it can reduce the size and cost of relief valves, relief piping, and flaring equipment, therefore saving capital expenses.

HIPPS is designed to close the valves and isolate the process at its source when an overpressurization event is detected. It can replace mechanical and flare systems.



Thief Hatch

Control and Protect

Thief hatches provide tank access and help mitigate point source emissions under normal operation. They improve the seal and reduce the overpressure during relief events while reducing vented emissions. Thief hatches are designed to be used in applications:

- Where tight sealing is critical
- To prevent the loss of vapours in a closed storage system



Pressure Vacuum Relief Vent (PVRV)

Ensure Pressure Control

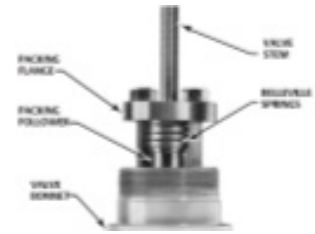
PVRVs provide vital pressure control as the tank pressure increases or decreases due to pumping liquid in or out of tanks or temperature changes. They ensure that the tank remains closed under normal operation, eliminating the loss of vapour from the tank head space.



Enviro-SEAL™ Packing

Seal, Conserve and Protect

This solution provides exceptional sealing capabilities for valves to help seal the process, conserve valuable fluids, and protect the environment against the emission of hazardous or polluting liquids and gases. Live-loaded packing provides a constant load over the life of the packing material, which reduces the need for packing box adjustment and maintenance.



Vent Gas Capture SlipStream®

SlipStream®

Fuel gas vented from point sources, such as instrumentation, cactus dryers, glycol dehydrators, condensate tanks, compressor packing vents, and wellhead casing, can be captured and combusted. This eliminates the use of fuel otherwise required to operate the engine, flare, generator, thermoelectric generator (TEG), solid oxide fuel cell (SOFC), or heater at site.



This can be used as a supplementary fuel source that improves efficiency while reducing CO₂(e) and VOCs.

Variable Frequency Drive (VFD)

Increase Energy Efficiency

VFDs can be applied to many variable speed systems to increase the overall energy efficiency and reduce power consumption. Applied to a compressor, a VFD provides compression controlled by motor rather than valves and diaphragms. The energy needed to start and stop a system is also minimized using VFDs. The pumpjack, and consequently production at the wellhead, can be optimized with variable speed control for the measured downhole conditions.

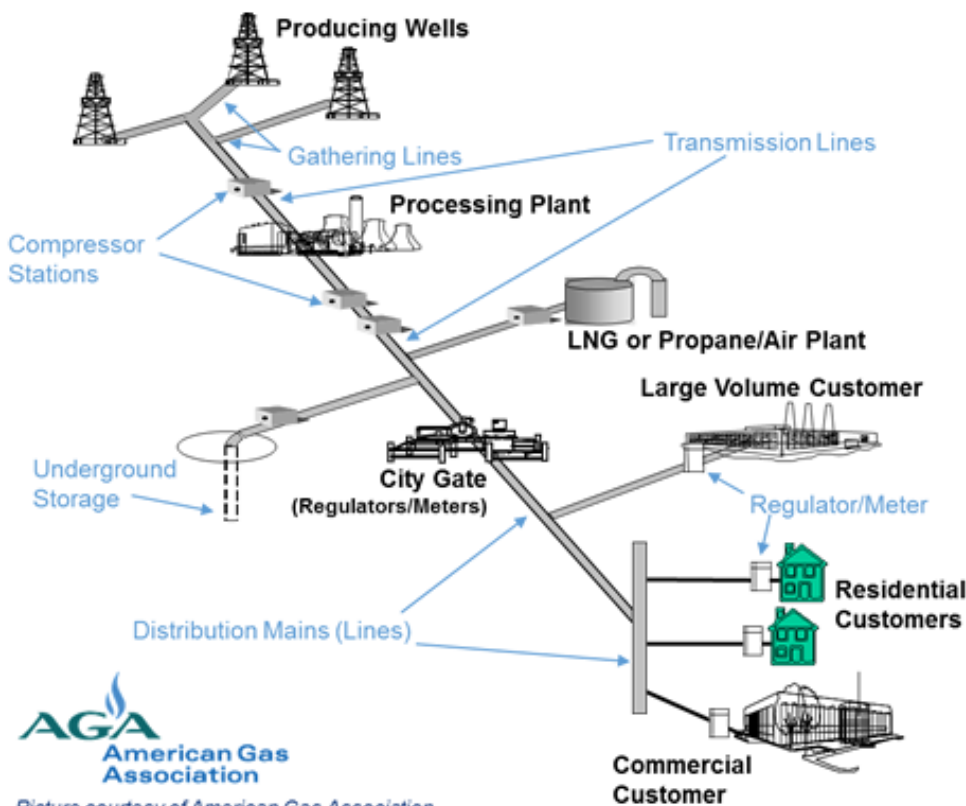
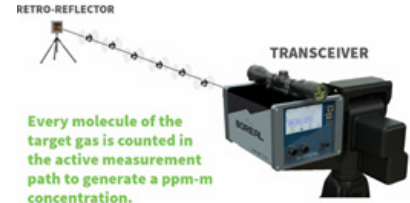


Open Path Gas Detection

Monitor Fugitive Emissions

Boreal Laser provides the opportunity to monitor fugitive emissions continuously at sites to ensure they are in fact producing hydrocarbons without releasing them to atmosphere.

Measuring and/or monitoring gas concentration excursions above atmospheric pressure can be combined with meteorological instrumentation and various dispersion models to generate either a plume model, mas flux, mass flow rate or an estimated emission rate for community monitoring or regulatory purposes.



Picture courtesy of American Gas Association

- Production**
- Pneumatic Controllers
 - Gathering/Boosting Stations
 - Tanks
 - Chemical Injection Pumps

- Gathering and Processing**
- Reciprocating Compressors
 - Centrifugal Compressors
 - Gas Engines
 - Blowdowns/Venting

- Transmission**
- Reciprocating Compressors
 - Station Fugitives
 - Engines
 - Pipelines

- Distribution**
- Mishaps (Dig-ins)
 - Residential
 - Mains - Unprotected Steel
 - Services - Unprotected Steel

United States Environmental Protection Agency. (2018). Overview of the Oil and Natural Gas Industry. [Digital Image]. Retrieved from <https://www.epa.gov/natural-gas-star-program/overview-oil-and-natural-gas-industry>

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