

DRIVING GAS DISTRIBUTION METHANE EMISSIONS REDUCTION USING TECHNOLOGY

RESPONSIBLE INNOVATION JANUARY 2024



EXECUTIVE SUMMARY

In today's world, the importance of Environmental, Social, and Governance (ESG) goals cannot be overstated. Gas distribution utilities play a crucial role in ensuring the availability of an essential natural resource. Together with regulators, customers and stakeholders, leading utilities are setting new standards in regards to ESG performance.

To support their ESG goals, technology can be a game-changer. Utility companies are transforming to new ways of constructing, maintaining and operating gas distribution assets to reduce emissions. Alongside advancements in leak detection and monitoring, gas utilities are also implementing new methods of repairing and preventing leaks.

Activities such as abandonments and gas main replacement result in the need to evacuate natural gas from the pipeline. New tools now make it possible to recover those emissions to minimize environmental impact. Involuntary emissions resulting from excavation damage, which can negatively impact ESG goals, are also seen as a priority. New technologies are being deployed to support advanced locating and mapping of assets—reducing accidental damaged to mains and services.

Overall, technology empowers gas distribution utilities to enhance their environmental performance, engage with the community, and adhere to good governance practices. By harnessing the potential of technology, these utilities can make significant strides towards achieving their ESG goals, ensuring a greener and more sustainable future.

Whether developing the technology or adopting it into standard practices to support ESG, we call this *Responsible Innovation*.

Responsible Innovation: Technologies that Drive ESG Performance



Robotic internal cast iron joint sealing delivers critical leak repair with less disruption.



Live gas main CCTV enables accurate mapping of distribution assets for damage prevention.



Portable emissions recovery reduces voluntary emissions from distribution systems.



THE ROLE OF TECHNOLOGY IN ESG & METHANE EMISSIONS REDUCTION

Gas distribution utilities are an essential part of our modern world, providing us with the energy we need to power our homes and businesses. In the process of maintaining and upgrading gas distribution infrastructure, utilities also contribute to the release of methane, a potent greenhouse gas that is a major driver of climate change.

Over the past several years, leading gas utilities have stepped up to take a stand on these emissions by setting aggressive ESG and emissions reduction targets.

According to the American Gas Association, the natural gas industry is committed to achieving significant emissions reduction through innovation, infrastructure upgrades and advanced technologies. Collectively, the industry has driven down emissions from the gas distribution system by 69% since 1990.

Methane Sources from Gas Distribution Systems

So, what are the top sources of methane emissions at these utilities? Well, one of the main culprits is the leakage from natural gas pipelines. Over time, these pipelines can develop leaks, allowing methane to escape into the atmosphere. In cast iron gas distribution mains, leaks can form at the joints over time, which is addressed by repairing the leak externally, rehabilitating the gas main or replacing the gas main.



Above: Excavation in roadway to expose and externally repair a leaking cast iron gas main joint.



Above: Example of roadway disruption resulting from pipeline replacement activity.

Another significant source of methane emissions is the venting and flaring of natural gas during routine maintenance and emergencies. When gas needs to be released from the distribution system, it is often vented, resulting in the release of methane. This venting procedure, also referred to as a blowdown, is often performed when abandoning the gas main.

Lastly, equipment malfunctions, operational inefficiencies and accidental damages to gas infrastructure can also contribute to methane emissions at gas distribution utilities. Excavation damage to unmapped or mis-marked gas distribution assets can result in an uncontrolled release of gas which puts utility workers and the public at risk in addition to the environmental damages from methane.

By identifying and addressing these sources, gas distribution utilities are taking steps to further reduce methane emissions and work towards a more sustainable future.

Redefining Social Disruption for Gas Customers

Gas utilities are responsible or ensuring a safe and reliable energy delivery system while balancing increased pressure from utility customers, regulators and stakeholders to maintain a positive experience for energy customers and stakeholders.

In addition to driving methane emissions reduction, gas utilities are increasingly working to redefine how they deliver energy in a way that is less disruptive to customers. Types of social disruption that utilities may cause include excavation, noise, disruption to energy supplies, traffic disruption and reduced air quality. **Excavation:** As the majority of gas distribution mains and services are buried, accessing these pipelines for maintenance, repair or replacement results in excavation of some type. Excavations such as a bar hole or pot hole, which are required for leak monitoring and to verify asset location, can be very small and unobtrusive. To support general pipeline maintenance, fitting installation, tapping and other standard procedures, a 4ft by 6ft excavation is typical. For replacement of a pipeline, complete trenching of the roadway is often required.

Utility excavation is a challenge for customers as it directly causes additional forms of disruption including noise and traffic. While the cost for excavation continues to increase significantly, utilities have found ways to decrease costs using trenchless technology, which works to reduce the requirements for large scale excavations and get more work accomplished through fewer excavations.

Noise: The primary driver for noise complaints in relation to gas distribution utilities is construction and excavation. Heavy construction equipment on site, movement of large pipes and even the constant banging of uneven road plates can turn a well planned construction project into a customer complaint.

Gas utilities are mitigating noise by reducing the duration of the projects and utilizing trenchless technology to minimize excavation.

Natural Gas Supply: Gas customers, regulators and stakeholders expect utility companies to provide an uninterrupted supply of energy to customers. Loss of heating and cooking supply for residential customers translates to increased food and temporary housing costs. Commercial customers can face even greater losses. Once the supply has been interrupted, the customer must wait for utility personnel to enter the premises to conduct a relight. This can require the customer to miss work for the appointment, which can result in a loss of income.

As urban centers continue to transform into smart cities, gas distribution utilities will need to work smarter to avoid disruptions.

Traffic Disruption: The majority of gas distribution network repair, maintenance and construction activity results in some form of disruption to traffic, sidewalks and bike lanes. This disruption can be magnified significantly in urban areas.

Large scale replacement projects can require the rerouting of key traffic lanes, sending vehicles into side streets that were not designed to handle larger volumes of traffic. In addition to creating traffic backups, road closures on commercial street disrupt local businesses. Over long-term projects, commercial businesses whose customers have trouble accessing the business location can suffer financial losses.

Utility excavation activity is not limited to roadways. These activities can also impact sidewalks and pedestrian lanes.

Air Quality: The natural gas industry has invested heavily into energy efficiency, which has saved more than 13.5 million metric tons of CO2 emissions between 2013 and 2019. The industry continues to work to reduce impact to air quality by reducing the venting of natural gas and addressing leakage from the gas distribution system.



THE IMPACT OF METHANE

Methane, a potent greenhouse gas, has a significant environmental impact that cannot be ignored. While carbon dioxide often takes the spotlight when it comes to climate change discussions, methane is much more powerful in trapping heat in our atmosphere.

The environmental consequences of methane are farreaching. It contributes to the warming of our planet, leading to rising sea levels, extreme weather events, and the loss of precious wildlife habitats. Furthermore, methane has a detrimental effect on air quality, exacerbating respiratory issues and posing a threat to human health. It is crucial for us to take immediate action to reduce methane emissions and develop sustainable practices to mitigate its environmental impact. By doing so, we can protect our planet and ensure a healthier future for generations to come.

TECHNOLOGIES THAT DRIVE GAS DISTRIBUTION ESG GOALS

In today's world, environmental, social, and governance (ESG) goals are of utmost importance for gas distribution utilities. These goals are centered around reducing greenhouse gas emissions, promoting sustainability, and fostering social responsibility. Technology is already playing a crucial role in helping gas distribution utilities meet their ESG goals.

One way technology is contributing is through the implementation of advanced leak repair methods that provide trenchless, remote repair and prevention of gas leaks and emissions. By addressing leaks with less excavation, utilities minimize methane emissions and prevent environmental damage while reducing impact on the public.

Issues around accidental damages to gas infrastructure can result in uncontrolled release of natural gas--putting communities and the environment at risk. Many of these issues stem back to outdated mapping, missing records and unlocateable PE mains. New methods and technologies are providing utilities with highly accurate locations of gas distribution assets to avoid damages.

Lastly, the adoption of portable emissions recovery is helping gas distribution utilities eliminate the venting of methane into the atmosphere during routine operations and abandonments.

Moreover, technology can facilitate the reduction of emissions from gas distribution infrastructure, promoting the use of cleaner and more sustainable energy. Overall, the adoption of technology in gas distribution utilities is not only instrumental in achieving ESG goals but also in creating a greener and more sustainable future.

ESG TECHNOLOGY PROFILE: ADDRESSING CAST IRON GAS MAIN LEAKAGE USING PIPELINE ROBOTS

Gas distribution utilities who operate and maintain large diameter cast iron mains face the high costs and disruption associated with replacing the pipe as well as the challenges of maintaining these assets. CISBOT enables gas networks to safely extend the life of these assets with no disruption of gas service to customers and reduced impact to the public and the environment.



Background

Large diameter cast iron gas distribution mains were installed in the late 1800s through the mid-1900s to deliver gas to customers in urban areas such as New York City, Boston, Chicago, Detroit Philadelphia, and London. These pipes were installed in 9ft and 12ft segments and joints by either jute-lead bell and spigot joints or mechanical joints that utilized a rubber gasket. When these assets were first utilized, they were designed to transport manufactured gas which was moist in nature and kept the seals intact.

When natural gas was introduced into these assets, which has a dry quality compared to manufactured gas, the joints connecting the cast iron pipes began to dry out of the years. Combined with thermal expansion and contraction as well as vibration from increased traffic flow, the joint packing material that creates the seal began to become brittle and prone to leakage. To address this leakage, utilities invest heavily in upgrading and maintaining these assets. This translates directly into either (1) excavations over every joint to conduct an external joint repair or (2) utilizing direct burial replacement to install a completely new gas main. With the increasing cost of excavation and trenching, addressing this leakage has become a financial burden—not to mention highly disruptive to the dense communities where these pipeline are in use.

According to data published by PHMSA and information provided by utilities, there are several hundred miles of 12"-48" gas mains still in operation between the US and UK.

Solution

Perhaps the most common joint remediation technique for large diameter joints was to apply an anaerobic sealant to the joint externally—but the need for an excavation over every joint increased costs and disruption dramatically. This was the moment when gas utilities realized that if they could inject the sealant into the joint from the inside, multiple joints could be remediated from a single excavation.

CISBOT was developed in partnership with Con Edison and National Grid to enter live medium and large diameter cast iron gas distribution mains through a very small site footprint. The robot travels hundreds of feet in either direction to seal all the joints accessible in the mains. The tethered robot is launched into the main through a launch tube installed on the gas main. Once inside, the robot travels to each joint to inject an industry-proven anaerobic sealant at multiple clock positions. During the joint sealing process, onboard cameras are used to monitor the process and confirm the joint is accepting the sealant.

From one small site footprint, CISBOT is launched into the live cast iron gas main to seal up to 110 joints—providing both a reactive and proactive solution to joint leaks.

Impact

To date, CISBOT has sealed over 50,000 leak-prone joints in the US and UK to create a positive impact on utility ESG goals by sealing existing leaks and preventing new leaks from forming for decades to come. For utilities that adopt CISBOT, the solution benefits leak response efforts and capital programs in addition to ESG goals.

From a social benefits perspective, CISBOT's low-dig methodology nearly eliminates excavation. By reducing excavation, this solution reduces heavy construction equipment required on site – reducing

the size and carbon emissions of work sites. This positively supports an improved air quality in urban areas where these large diameter cast iron assets are generally located. CISBOT's trenchless method works to protect investments in roadways and safeguard against future excavations. The smaller work sites equivalate to less road closures and disruption to traffic, pedestrians, and cyclists.

Since all work is performed under live conditions, there is no disruption of gas service to customers who trust LDCs to deliver a safe and reliable supply of energy for heat and cooking.

Take Action

Gas leaks can pose significant risks to both the environment and public safety. While current proposed regulations appear laser focused on technology for leak surveys, utilities and stakeholders need to also implement innovative methods of repairing and preventing leaks.

The deployment of CISBOT demonstrates the utility industry's commitment to reducing greenhouse gas emissions and minimizing their carbon footprint. Repairing gas leaks not only prevents the release of harmful methane gas into the atmosphere but also help conserve natural resources. Furthermore, it promotes public safety by preventing potential accidents and fire hazards associated with gas leaks. Gas utilities that prioritize the repair of gas leaks are not only fulfilling their environmental responsibilities but also enhancing their reputation as responsible and sustainable energy providers.

While current proposed regulations appear laser-focused on technology for leak surveys, utilities are also implementing innovative methods of repairing and preventing leaks.

ESG TECHNOLOGY PROFILE: GAS DISTRIBUTION PORTABLE EMISSIONS RECOVERY TECHNOLOGY

Gas distribution utilities invest heavily in the replacement and abandonment of leak prone mains. As part of this process, utilities need to evacuate any remaining natural gas. New technologies for emissions recovery are helping utilities reduce venting to meet ESG goals.



Background

Gas distribution utilities are responsible for providing a safe and reliable supply of natural gas to consumers. As part of that promise, utilities work to prevent the release of natural gas into the atmosphere. However, the release of natural gas from distribution mains may still be required for pipeline abandonments, pipeline construction and routine maintenance activities.

The venting of methane results in a negative impact to the environment, but also has an adverse affect on air quality for customers. The release of methane in urban areas can result in odor complaints, putting an unnecessary strain on emergency response personnel and resources that may be needed elsewhere.

Utilities have been using emissions recovery products and services for years, but efforts have been largely focused on higher pressure

mains and larger volumes of pipe. This equipment was designed with multiple stages of compressions to accommodate higher pressures at a lower flow rate. Multiple stages of compressions, however, negatively affect product performance when working in typical distribution pressures.

Solution

As the world continues to prioritize environmental sustainability, gas distribution utilities are under increasing pressure to reduce their emissions and meet ESG (Environmental, Social, and Governance) goals. One effective solution that can help these utilities achieve their targets is the implementation of emissions recovery technology.

This innovative technology allows for the capture and reuse of natural gas, minimizing the release into the atmosphere. By adopting emissions recovery technology, gas distribution utilities are significantly reducing their carbon footprint and contributing to a cleaner and greener future.

For distribution utilities, sourcing equipment that offers a single stage of compression will deliver the most efficient results. Emissions recovery efficiency will be a key factor in the ability for field teams to adopt and scale deployment of the technology. Faster recovery times will reduce impact on construction schedules and help reduce barriers to adopting the technology.

Fuel source and safety are also key factors when selecting equipment. Units that utilize natural gas as the primary fuel source reduce reliance on diesel compressors and lead to lower carbon emissions for the project. Automated safety features such as overpressurization protection align with increased regulatory concerns and protect workers.

ULC Technologies' DDC-125 Drawdown Compressor technology was designed to deliver efficient emissions recovery within a full gas distribution pressure range. Using natural gas as the primary fuel source, it removes the need for diesel compressors on site to reduce costs. The unit is also equipped with automated safety features including over-pressurization protection.

Impact

Emissions recovery technology not only aligns with utility ESG goals but also promotes cost savings and operational efficiency. By embracing emissions recovery technology, gas distribution utilities are demonstrating their commitment to sustainability and paving the way for a more sustainable energy sector.

These voluntary emissions reduction initiatives demonstrate the commitment of gas distribution utilities to environmental sustainability and their dedication to being responsible corporate citizens.

Take Action

While utilities need to continue to focus on upstream applications for emissions recovery, now is the time to analyze how this technology can positively impact gas main replacement programs, pipeline abandonments, and routine maintenance.

There is a large-scale effort among gas distribution networks to replace leak prone pipe. Recovering emissions from those assets as they are abandoned or removed is a critical element in utility ESG and methane emissions reduction goals.

The DDC-125 Drawdown Compressor from ULC Technologies was developed to deliver efficient emissions recovery within gas distribution pressure ranges. Using natural gas from the discharge side, the unit is both efficient and green.

To reduce the risk of accidental damages to gas distribution assets and improve mapping, new technologies enable the accurate mapping of gas mains, services and pipeline features.

ESG TECHNOLOGY PROFILE: ADDRESSING ADVANCED TECHNOLOGIES FOR DAMAGE PREVENTION AND MAPPING

Accidental damages to gas distribution assets pose a significant threat to customers, workers, and the environment. Gas distribution utilities need accurate and reliable maps of assets to support damage prevention and reduce risk of gas escape related risks.

Background

As the world continues to prioritize environmental, social, and governance (ESG) goals, the need for improved mapping of gas distribution utility assets becomes increasingly evident. By mapping gas pipelines and distribution networks more effectively, utility companies can identify areas that are prone to leaks or at a high risk of excavation damage. Accidental damages to gas mains and services can lead to uncontrolled gas escapes--risking the safety of workers and communities as well as the environment.

Enhanced mapping can also help utility companies better understand the social impact of their operations, such as identifying areas where gas supply may be limited or where vulnerable communities may be disproportionately affected. Furthermore, improved mapping can contribute to better governance by ensuring that utility companies have a comprehensive understanding of their assets and can make informed decisions about maintenance and infrastructure upgrades. By leveraging advanced mapping technologies and data analytics, gas distribution utility companies can proactively address environmental concerns, contribute to social well-being, and enhance their overall governance practices, aligning with their ESG goals.

Solutions

To reduce the risk of accidental damages to gas distribution assets and improve mapping, new technologies enable the accurate mapping of gas mains, gas services and pipeline features. Inpipe locating is the process of deploying a live gas main camera to deliver highly accurate locating and mapping of underground assets.

Once inside the gas distribution asset, the camera enables the operator to visually identify pipeline features such as offsets, branches, service taps and stubs. The camera is positioned at a feature and, using an internal sonde, can be located and marked out from above ground.

The mark out produced by in-pipe locating provides the details excavation crews need to excavate safely around mains and reduce accidental damages to gas infrastructure. These marks can also be captured by GPS tools to update GIS maps with the most accurate details and locations of assets.

For utility construction projects, determining the accurate location of all underground assets is critical to a successful project.

While in-pipe locating is used to map gas assets, accurate mapping of all underground assets is required to identify trenching locations and prevent damages to non-gas assets. AUSMOS is a newly developed autonomous mobile robotic platform that combines Ground Penetrating Radar (GPR) and Electromagnetic (EM) sensors to make sensor data more accessible and actionable for utilities. Using technology like this, utilities have greater access to detailed information on the location and depth of buried assets.

Impact

Accidental damages to gas mains can cause a severe, uncontrolled rupture of the main--potentially venting natural gas into the atmosphere and putting communities and people at risk. In-pipe locating has been deployed with multiple gas utility companies and contractors to prevent these damages.

The improved mapping and asset information made available by new technologies ensures that utilities have a comprehensive understanding of their assets to better manage their assets and support damage prevention efforts.







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ULC TECHNOLOGIES: LEADING RESPONSIBLE INNOVATION THROUGH TECHNOLOGY DEVELOPMENT AND ADVANCED FIELD SERVICES.

Today's leading energy, utility and industrial businesses have found new ways to deliver critical services to customers while minimizing public disruption, improving safety, lowering costs and reducing environmental impact. ULC Technologies works alongside innovative companies to develop and deploy robotic platforms and inspection systems utilizing AI & machine learning, with the goal of delivering a positive impact utility ESG and emissions reduction goals.



TALK TO OUR TEAM ABOUT OUR TECHNOLOGIES

For inquiries about technologies mentioned in this whitepaper or to learn more about our R&D services, please contact our team using the link below or call 1-631-667-9200.

